COMMISSION OF THE EUROPEAN COMMUNITIES

Information on agriculture

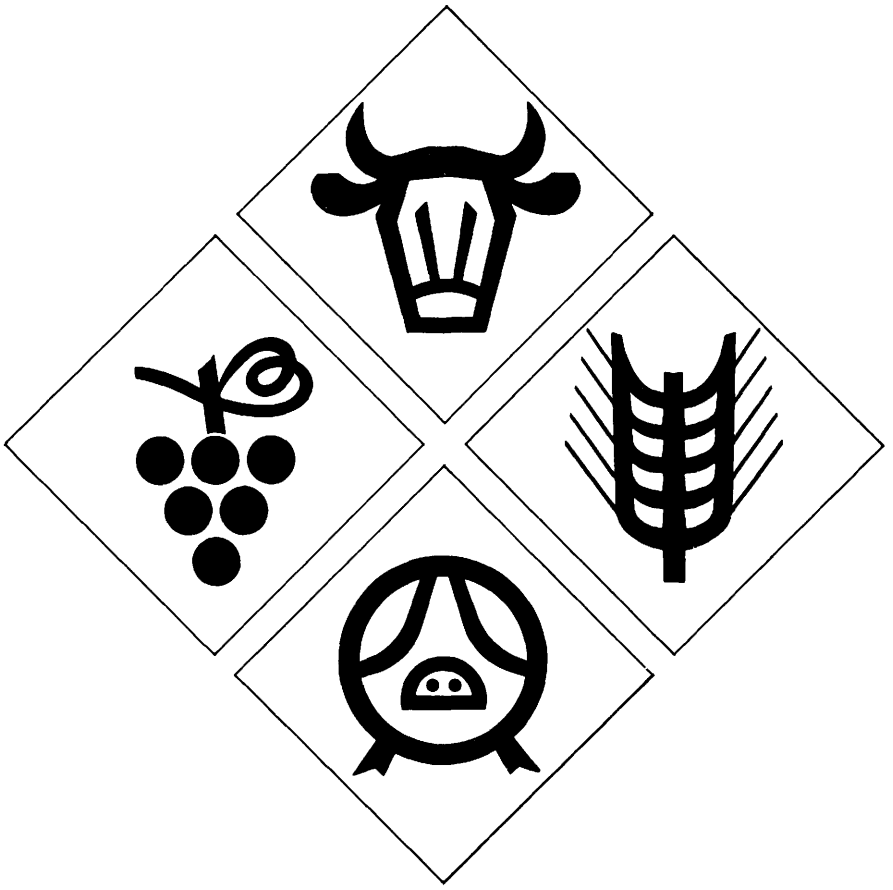
Potato products: Production and Markets in the European Communities

No. 75

COMMISSION OF THE EUROPEAN COMMUNITIES

Information on agriculture

Potato products: Production and Markets in the European Communities



Manuscript finished in June 1980.

No. 75

COMMISSION OF THE EUROPEAN COMMUNITIES

DIRECTORATE-GENERAL FOR AGRICULTURE

Directorate General matters — Division "Reports, studies, statistics and documentation"

A bibliographical slip can be found at the end of this volume

Luxembourg: Office for Official Publications
of the European Communities, 1981

ISBN 92-825-2230-X

Catalogue number: CB-NA-80-075-EN-C

Printed in Belgium

FOREWORD

This study has been undertaken in the framework of the study programme of the Directorate General of Agriculture of the Commission of the European Communities.

The report was prepared by N.A. YOUNG, Research officer at the Centre for European Agriculture studies of Wye College (University of London),Ashford-Kent - England.

The Division "Tobacco, hops, potatoes and other specialized crops" and the Division "Reports, studies, statistical information, documentation" of the Directorate-General for Agriculture participated in the work.

Original language : English

The present study does not necessarily reflect the views of the Commission of the European Communities in this area and in no way anticipates the Commission's future attitude towards this matter.

PREFACE

In 1975, when the Centre for European Agricultural Studies began its research into the EEC potato sector, we were inevitably confronted with the insular attitudes held by people working in this sector and by the lack of understanding of each other's marketing systems. Thus sadly, as is so often the case, important misconceptions about the EEC potato industry were rife.

It is easy to understand why such a situation prevailed. Historically, within Europe, trade in fresh potatoes has been fairly modest with most temperate countries exhibiting high levels of self-sufficiency, largely because of the high cost of transporting potatoes. There was no common organisation of the potato industry within the EEC and a number of countries had maintained national policies to support and protect their own potato producers. Consequently, for some countries there was little need to show interest in circumstances outside their national borders.

Today, several years on, some progress has been made towards a more integrated Community market. This has largely resulted from the Charmasson judgment which led to France and eventually the United Kingdom removing quantitative restrictions on trade. However, it is more difficult to provide evidence that there exists greater mutual understanding between Member States as the stalemate in the negotiations for a common organisation of the potato market witnesses. We suspect that there has been some progress towards understanding and we hope to have played a small part in the process through the publication of the results of our research on potato marketing systems[1].

In the same way this report sets out to make a positive contribution to the understanding of a relatively new and fast developing part of the potato sector. The potato processor is an indispensable partner in the European potato sector and his importance will continue to grow. With this development comes the challenge of coping with new relationships in the industry and the difficulties of adjusting to new circumstances. However, in a potato sector which is faced with stagnant if not contracting demand for fresh ware potatoes in most Member States of the European Community the development of this part of the industry represents a major challenge.

---

1 Young, N.A., The Dutch Ware Potato Marketing System, 1977.
Young, N.A., The French Maincrop Potato Marketing System, 1978.
Smith, P.E. and Young, N.A., The West German Potato Marketing System, 1979.

New areas where future study can contribute to greater understanding of the prospects of the EEC potato industry are suggested in the report and highest priority must go to assessing the nature of long-term competition from potato products manufactured in North America and Eastern Europe.

The report has been written by Nick Young. Assistance was given in compiling the United Kingdom report by Pat Smith, who visited processors in that country. The report has been typed by Sandra Bland, Delia Copland and Jean Rolph.

The author wishes to acknowledge the help of many people throughout the potato processing industry of the European Communities in the compilation of this report. A large number (too many to mention personally) gave a generous amount of their time in discussing the problems of the sector. Particular thanks are due to the Union Européenne des Industries de Transformation de la Pomme de terre (UEITP) and their secretary, Mr. Cleophas, for his patient encouragement.

I.G. Reid,
Director,
Centre for European Agricultural Studies.

CONTENTS

THE MANUFACTURE OF POTATO PRODUCTS FOR

HUMAN CONSUMPTION IN THE EUROPEAN COMMUNITIES

INTRODUCTION

The main aim of this report has been to provide an account of the development of the potato processing industry, its relationship to the potato production sector and its major problems and difficulties. According to our brief, our coverage of the potato processing industry has excluded the manufacture of industrial products such as starch and alcohol and the dehydration of potatoes for animal feed. It has also excluded any consideration of businesses concerned only with the preparation of potatoes by peeling alone and the manufacture of potato flour. This report was written to provide the Commission of the European Communities with an outline of the way in which the potato processing industry operates so that it might have a full appreciation of the nature of the industry and its likely influence on the development of the potato sector.

It would have been fairly easy to have set out on a full scale postal or interview survey of potato processors in order to collect basic data about the industry and about the individual firms in that industry. However, the author's experience of potato marketing systems suggested that such a formal approach would neither provide all the information which could be considered to be necessary, nor would it provide the Commission with the most appropriate information for its needs. We knew that many organisations were keen to retain confidentiality over certain aspects of their potato processing operations (e.g. raw material procurement, throughput and the manufacturing process) and consequently a formal interview approach would not have been very fruitful. It was considered necessary to collect as much basic information as necessary through published sources and to informally discuss the problems of the potato and potato processing sectors with a cross-section of people concerned with these sectors in each individual country. In particular we set out to visit a wide range of potato processors who had been chosen specifically because they were either operating on a significant scale or representative of a particular set of circumstances. In total we spoke to representatives of more than 40 manufacturing organisations during late 1978 and 1979 and this included almost all of the major processors in the EEC.

The discussions centred upon the major problems and difficulties of manufacturers and their view of various aspects of the potato production and potato processing sectors. Overall the interviews provided a good indication of the major points of concern of processors and the main factors which seem likely to shape the future development of the industry. As one might expect, some sectors are more easy to come to grips with than others. A particular problem has been assessing the development of the canning sector with its many firms, often with only infrequent and very modest interest in potatoes, and its dearth of statistical information. For the same reason it has been very difficult to give a comprehensive account of the manufacture of some of the other minority products.

The manufacturers of potato flakes and granules in the EEC are currently faced with a major challenge for European markets from North America and Eastern Europe (Poland and Hungary) and the long-term

competitiveness of the European potato dehydration industry will be affected by developments in these countries. In the absence of specific research on the potato processing industries of North America and Eastern Europe it is difficult to arrive at conclusions on the future prospects of this sector. Unfortunately it has not been possible to incorporate such research into this programme of work.

The report has been divided into 6 sections. As necessary background Section I provides a broad description of the history of the potato processing sector up to the end of the Second World War. Section II gives a description and classification of the different types of potato products found within the industry. In order to give an appreciation of raw material procurement problems Section III provides a description of the chemical composition of the potato, the qualities which are important to processors and the way in which quality can be affected by production, storage and processing techniques. Section IV looks at the potato processing business from the point of view of three of its most important elements: raw material procurement; the manufacturing process and marketing considerations. Each of the major groups of potato products is considered separately. Section V describes in detail the potato processing industry of each of the Member States. A brief description of the potato sector is given for each country so that the processing sector can be placed in context. For the four major potato processing countries (the Netherlands, West Germany, France and the United Kingdom) the industry is described in terms of its historical development; current position, structure and location; the potato marketing system and raw material supplies, external trade, demand and the institutional factors which have affected its development. Those countries with small processing industries are described in much broader terms but again the production sector is also described. Finally, Section VI considers a number of issues which are relevant to the Community as a whole.

SECTION I: THE EARLY DEVELOPMENT OF THE POTATO PROCESSING INDUSTRY

The development of the potato processing industry in Europe has taken place largely within the short period since the end of the Second World War. However, the possibilities of processing potatoes for both human consumption and industrial utilisations have been explored continually and the purpose of this section is to describe some of the efforts which went into developing processed potato products prior to the development of the industry as we know it today.

All early efforts to process potatoes were initiated by the desire to overcome the twin disadvantages of the potato - its bulk and its perishability. Potatoes may have been 'processed' in very primitive forms from the earliest days; indeed there is some evidence to suggest that crude dehydration was used as a means of preserving potatoes almost 2,000 years ago by South American Indians (Salaman, 1949 and Burton, 1966). The alternate freezing and drying of potatoes to produce a preservable product called 'chuno' is still practised by the inhabitants of some South American countries in exactly the same way as their forebears. The cultivation of potatoes in Europe began from the sixteenth century and in the eighteenth and nineteenth centuries it became a major food source over large parts of the continent. The potato is understood to have reached North American shores in the early seventeenth century and production increased following its promotion by waves of Europeans who emigrated to the New World in later centuries.

As with other important foods, on both continents there was every incentive to preserve potatoes during those periods when fresh crops could not be harvested. As a result, a number of experiments were carried out to try to dehydrate the vegetable in order to preserve it until the harvest of the next year. These experiments began towards the end of the eighteenth century and extra impetus was provided by the search for suitable foods to be included in the provisions for ships which were sailing the major trade routes of the world. Adler (1971) quotes two examples of German experiments to dehydrate potatoes in 1758 and 1785, the first of which includes the basic elements in the manufacture of potato flour. Parmentier referred to dehydrated potatoes in a paper published in Paris in 1781 and there is evidence that similar products were being produced in England at the same time (Burton, in Salaman, 1949). Attempts to dry potatoes on a small scale continued during the nineteenth century (Salaman, 1949) and industrial scale drying was introduced for the first time towards the end of the century.

During the nineteenth century there is evidence of dried potatoes being used on trade routes and some of the major expeditions of the time. A patent was taken out in 1840 by Edwards - for a method which dried potatoes which had been pushed through holes in a metal cylinder on metal tables heated from below. It is reliably reported that the resultant product was not very well received and that "the seamen did not take to the potatoes" (International Tin Research and Development Council, 1939).

Adler (1971) notes that in Germany the problem of disposing of surpluses at the end of the nineteenth century prompted competitions to discover better ways of preserving potatoes, and as a result a number of new products such as sticks, slices and flakes were produced mainly for animal feed. In 1901 an Austrian patent for a drum-drying process was granted, although again the product was utilised as animal feed.

However, dehydrated potatoes were utilised for human food prior to World War I in the United Kingdom and probably Germany. Dykes (1921) for example, mentions potato flour being used in the United Kingdom in the manufacture of soup powders (desiccated soups). Because they were particularly suitable as military rations, dried foods of all kinds were used during World War I and this gave a fillip to the industry throughout Europe. Civilian use was also increased, particularly in Germany where potato flour was incorporated in bread flour (at a level of 10%) by regulation (Adler, 1971). Although other extenders were used, the poor quality of war-time bread was apparently attributed to the potato flour and consequently such products had a bad name by the end of the war.

The quality of the dehydrated potato products used during this period was very poor and consequently, following the cessation of hostilities, the war industry disappeared in the United Kingdom. In mainland Europe modest quantities were dried after World War I, although it is understood that most of this was destined for animal feed (Dykes, 1921). It appears that dehydrated potato products did not become used as human food again in Europe until 1933 when the German government ordered bakers to use potato flour for up to 50% of their raw material. By the late 1930s the production of dried potatoes was begun again mainly to supply the German armed forces.

The development of the industry followed a very similar development in the United States with much activity during World War I to be followed by a decline in the war industry afterwards (Kueneman, in Talburt and Smith, 1975). However, the potato flour industry, which was introduced into the United States at the end of World War I, gradually expanded between the wars (Willard, in Talburt and Smith, 1975).

World War II provided new impetus for the processing of potatoes into a convenient non-bulky form and several countries engaged in World War II set out to produce large quantities of dehydrated potatoes for military and civilian use. The bulk of the production for the Allies was manufactured in the United States, but almost 100,000 tonnes of dried potato of all types were manufactured in the United Kingdom by some 20 factories established by the government (Salaman, 1949). The drying plants in Germany were also fully occupied and it is understood that by 1944 there was capacity for approximately 30,000 tonnes to be produced annually (Adler, 1971). At the end of World War II the United States potato flour industry expanded very rapidly to meet the food needs of Europe, although much of it was of very poor quality.

These war years proved to be the watershed for the development of the dehydrated potato industry. Prior to the 1940s the forms of dehydrated potatoes were limited to potato flour and potato slices. The manufacture of potato flour was carried out either by drying the raw potatoes by direct contact with hot air and grinding, or by cooking and drying between two internally heated rollers to form flakes or, if necessary, ground to produce a flour. Potato slices or strips were manufactured by drying in currents of air at lower temperatures than used for producing flour and were not ground. A further variation was the cooking or steaming of potatoes followed by extrusion and drying to produce riced potato. The flour produced by such methods was very sticky when reconstituted and could not be made into the form of the fresh cooked potatoes and the slices needed further cooking after reconstitution before it was possible to eat them. Neither of these forms of dehydrated potato product could be

rehydrated quickly and no product had been prepared which could be reconstituted to form a passable mashed potato product. The main reason for the poor quality product was the rupturing of the potato cell walls in the manufacturing process and although this was recognised as early as 1912 it was not until the late 1930s that processes were identified which could overcome the problem (see Burton, 1966, p.292). Several research workers appeared to have discovered solutions at roughly the same time although Volpertas and Buminovitch (both of whom were working in the United Kingdom at the time) are probably the true originators of the process which is the basis of today's potato granule industry.

This development led to the commercial exploitation of the process which was the first to provide an instant reconstituted product which resembled the fresh cooked and mashed potato. Two British firms began producing this improved product during World War II and "Pom", a brand name of the Chivers company, became almost a generic name for mashed potato powder following the ending of the hostilities. "Pom" was widely distributed throughout Europe at the end of the war and, in the circumstances, was generally well accepted (Adler, 1971). Although these products showed a great improvement on their predecessors, their quality still left a lot to be desired, and even today it is claimed that the potential market for modern dehydrated products is hampered by war-time memories of "Pom". The key to the prevention of cell rupture during mashing and cooking was the 'add-back' process which involved the reduction of the moisture content of the cooked and mashed potato by 'adding back' already dried granules to give a moist mix which after retention for a short period can be satisfactorily sieved and dried to produce a fine powder. The scientific breakthrough soon found its way to the United States at the end of the war, and again, under the pressure to supply troops operating in yet another war, this time in Korea, the potato granules industry began a rapid development in the United States.

Later in the mid-1950s a number of technical developments permitted drum driers to be utilised to produce a satisfactory instant mashed potato product. The work of Cording and Willard in the United States brought two important modifications to the long established flaking process. Two-stage cooking, and later an intermediary cooling stage, reduced cell rupture to an acceptable level to permit potato flakes reconstitutable into mashed potato to be marketed as an alternative to the potato granules produced by the add-back process. The two different processes for producing dehydrated mashed potato granules and flakes are the basic methods used to produce most dehydrated products today.

A little after the initial work had been carried out on the dehydration of potatoes, the foundations for the preserving of food through canning or bottling were being laid by the Frenchman Nicholas Appert. Appert is acknowledged as the founder of the canning industry and as early as 1806 there are records of products produced by his sterilisation and bottling methods being used by the French navy. The 'invention' soon spread to other countries. By 1811 there is evidence that this method of preserving food was understood in the United Kingdom and by 1818 canned or bottled food was being used in the British navy and on the major trade routes. Developments in canning were rapid in the second half of the 19th century. The Australian industry began in 1848 and an American meat factory began production in the 1860s. Many technical developments were made in the United States with the increasing industrialisation of the canning process. Automatic sealing machines were introduced in 1897 and the first 'modern' can appeared in 1904.

By the end of the 19th century canning industries existed in several European countries although it was not until the 1930s that the industry really took off. Canned food had been widely used in World War I and demobbed soldiers carried back the acceptance of canned food into civilian life but the post-war slump put paid to any rapid development until the 1930s. World War II provided a greater stimulus to the acceptance of canned foods and the industry expanded rapidly to meet civilian and military needs. There is little documentation on the early canning or bottling of potatoes, although it seems quite likely that early pioneers might well have experimented with the canning of potatoes if only because they were an important part of the diet at that time and they were difficult to preserve in fresh form. There is evidence that the potatoes were canned in the United States for the first time in the 1920s and it seems likely that this would have also taken place in Europe very soon after, although, like today, they probably represented only a relatively insignificant part of the whole preserving sector.

In the early days, the principal merits of processed potato products lay in their reduced bulk and the enhanced possibilities for storage. This particularly encouraged the development of dehydrated and canned products. The convenience factor which brought about the rapid development in the processed potato market post-war was not valued until incomes began to rise rapidly during the 1950s and 1960s. Prior to that, the only time when convenience was highly valued was war time, when reduced bulk and quick preparation using simple, easily available materials were very important to military operations. In particular, the potato dehydration industry benefited from these circumstances.

The market circumstances necessary for the growth of the demand for convenience products were not present until late in the 1950s, when many people and institutions were able and prepared to pay for products which could be prepared quickly and easily. Until then there was a strong preference to prepare potato dishes from the fresh vegetable. In any case the development of the frozen french fries sector was inhibited by the lack of an infrastructure for the distribution and retailing of frozen foods as well as the lack of suitable storage facilities in most catering establishments.

It seems likely that the production of par-fried potatoes may well have taken place on a small-scale local basis in mainland Europe from a fairly early date because twice-frying was a normal procedure for cooks preparing chipped potatoes. In the United Kingdom and Ireland potatoes have been less commonly fried twice and so the early development of small-scale artisan based businesses preparing par-fried chips for other catering establishments seems unlikely. The industrial production of french fries is a phenomenon of post-World War II. Although the freezing of foods began on an industrial basis in the United States, Weaver, Reeve and Kueneman (in Talburt and Smith, 1975) suggest initial attempts to freeze potatoes were made before and during World War II in the United Kingdom, but these were on an experimental basis. However, the market for french fries first began to develop in Europe in the early 1960s. Initially, particularly in mainland Europe, it was the chilled product market which grew most rapidly although in the late 1960s the demand for frozen french fries began a period of rapid development.

Of the major potato processing sectors, the crisp industry should be regarded rather differently as it does not represent a means of preserving

potato, neither does it reduce the bulk of the finished packaged product. The crisp was therefore not a convenience food and the demand for crisps grew with the development of the market for snacks. This market developed at a very uneven rate in the different European countries. In many European countries the product was very slow to get established, mainly because the more traditional bread-based snacks were firmly entrenched.

According to Talbert (Smith and Talburt, 1975) crisps have been made in the United States since the middle of the nineteenth century, although industrial manufacture began much later with improved peeling and frying techniques. By 1939 just over 100,000 tonnes were being used in crisp manufacturing factories. In Europe prior to World War II they were only produced on an industrial scale in the United Kingdom and Germany. In the United Kingdom fried sliced potatoes were being prepared on a small scale from 1910 following a French household recipe. But it was not until 1920 that the first specialist crisp company emerged and by 1929 this company was operating on a fully industrial scale. Soon afterwards, a small company began producing crisps in Germany. The product came to be accepted more generally in Europe after the Second World War, and to a certain extent this was encouraged by the large number of North American troops in Europe, many of whom had already eaten potato crisps back in the United States. Indeed the North American influence on the development of the sector in mainland Europe is apparent through the use of the American terminology 'chips' rather than the British 'crisps'.

One very interesting feature of the development of the European potato processing industry compared with that of the United States is the separate development of each of the potato processing sectors. The true economic significance of this historic fact is only just making itself felt, but for a number of reasons, from an early stage, European plants were processing only one broad group of products. The principal reason for this has been the unequal development in the demand for the different products during the twentieth century. In particular the demand for industrially produced french fries did not take off in Europe until the mid-1960s by which time the separate crisp and dehydration sectors were reasonably well developed.

In this short section we have considered the early development of the potato processing industry. As we have seen the major technical problems occurred in the dehydration sector where a firm understanding of the chemical composition of the potato led to advances in the development of a process for the manufacture of a powder which could be reconstituted into an acceptable mashed potato product. In comparison, the technical problems associated with developing the crisp and french fry sectors were relatively straightforward. In these sectors, while there was still much to learn about the factors determining quality, the major challenge was that of applying engineering skills to permit industrial scale manufacture. By the middle of the 1950s most of the innovations necessary to cope with the industrialisation of the processes had been introduced and all the basic technical problems overcome. It remained for the economic growth of Western Europe and North America to produce incomes and social conditions which would favour the development of a wide range of processed products based on potatoes. This later development will be considered in subsequent sections.

2)

SECTION II: PROCESSED POTATO PRODUCTS

Having covered some of the background to the development of the different sectors of the potato processing industry, it is the purpose of this section to try to provide some systematic method of classifying the many different products which are available. In doing this, a rough outline of the nature of the manufacturing process will also be given. Much more detailed descriptions of the major processes will be given in later sections of this report.

In the historical section we have already distinguished between dehydrated products, crisps, french fries and preserves (canned and bottled potatoes). Whilst this categorisation is perfectly adequate to describe the early history of potato processing, it needs slight amendment to include all the products which are now available. In particular, the classification system needs to include snack products other than crisps, and fried products other than french fries. Consequently the classification system proposed distinguishes between the following categories:

dehydrated products;

snack products;

fried non-snack products;

non-fried frozen products;

preserves;

other products.

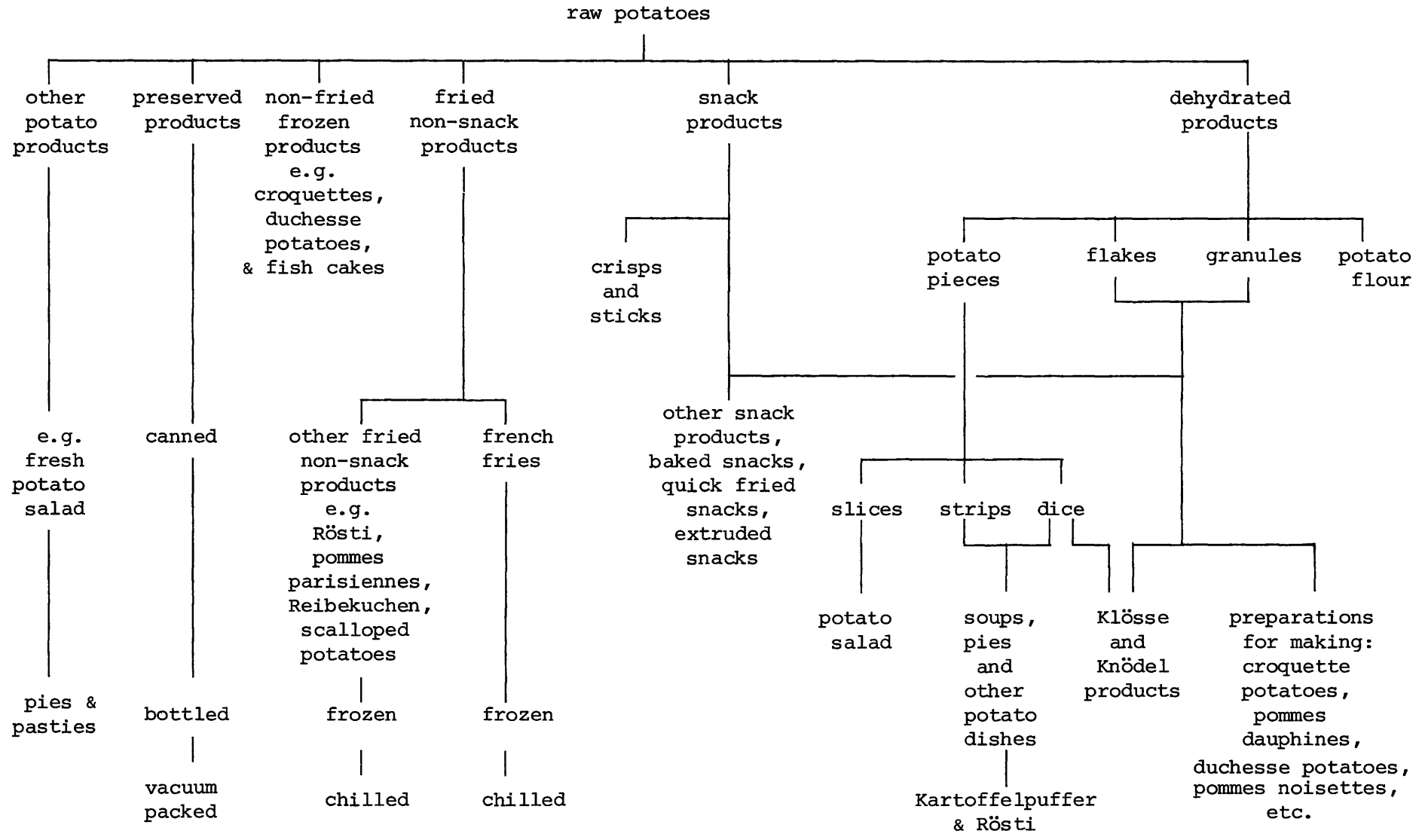
The last category includes a number of products which cannot be categorised elsewhere. These include products such as potato salad. The classification is shown in diagrammatic form in Fig. 1.

Dehydrated products

There are four major types of dehydrated products: potato granules, potato flakes, potato pieces and potato flour. The history of the development of an instant mashed potato was outlined in the earlier section. Potato granules and flakes now represent two alternative forms of instant mash. Potato granules are manufactured by the add-back process. After peeling, trimming and slicing, the potatoes are cooked in steam. Then they are mashed and mixed with some already dried granules and the resultant mix cooled. The mixture is held at this temperature for conditioning, mixed again and dried to 12-13 per cent moisture content. The mixture is then screened and the coarser material is returned back up the production line to serve as "add back" for the newly mashed potatoes. The finer material is dried again down to 6 per cent and then stored and any necessary components of the final product added (e.g. milk, salt, vitamin C). In the United Kingdom an additional rewetting process is used to produce small agglomerates of granule for some products.

The resultant granules can be reconstituted to form mashed potato, although the potato flake process produces a very similar product. This flake process involves two separate cooking operations separated by cooling. After this the potatoes are dried by spreading them on an internally heated drum drier which is usually equipped with 4 to 6 applicator rollers. The dried film of potatoes is then carefully broken

Figure 1 A classification of food products made from potatoes



off the rollers to the desired flake size. Various additives are utilised to improve the quality of both potato granules and potato flakes. These may include anti-oxidants, to reduce oxidation, and emulsifiers to improve the texture of the finished product. As noted previously, the essential feature in dehydrating potatoes to make a reconstitutable instant mash is the avoidance of the rupture of the starch cells. Both flakes and granules are also important intermediary products used in the production and preparation of potato-based dishes such as croquettes, duchesse potatoes, Klösse and Knödel (German potato dumplings), and in the manufacture of a wide range of snack products.

The production of dehydrated potato pieces is achieved by reducing the moisture content of potatoes in a number of stages. In the early stages the moisture content is reduced rapidly by high temperatures but later stages of moisture reduction are carried out more gradually until the desired 8 to 10% moisture content is achieved. The dehydrated potato pieces themselves are used for inclusion in a number of manufactured dishes such as soups, pies and casseroles, and some (sliced) are used in preparing potato salad, particularly in West Germany. In addition to this, other potato dishes such as Rösti and Kartoffelpuffer (potato pancakes) can be produced using grated dried potato pieces.

Klösse and Knödel products can take a number of different forms depending on whether cooked or uncooked dried potatoes are used. The cooked Klösse are made mainly from potato flakes and/or granules; "half and half" Klösse are made from a combination of flakes and/or granules and raw dehydrated potatoes which have been ground; and raw Klösse are made from grated or ground raw dehydrated potato pieces. These products comprise mainly dried potatoes but other ingredients such as starch and seasonings are very important in the formulation of the final product.

Snack products

The second major group of potato products include all those snacks which contain potato as an important ingredient. These snack products can be roughly divided into two main groups, those which are made from the raw potato, i.e. crisps and sticks, and those which are made from mixtures of potato granules or flakes and other ingredients which have been shaped and dried, baked or cooked. This latter category includes a very wide range of snack products which are differentiated mainly by shape, form and method of manufacture.

The basic crisp manufacturing process is relatively straightforward. After washing, peeling and trimming, the potatoes are thinly sliced and then fried in continuous friers. The crisps may then be flavoured before being packaged.

The snack products based on dehydrated potato granules or flakes are difficult to classify as the ingredients can vary from product to product. In general, however, categorisation is based on the process of manufacture. Some are produced by mixing the ingredients into a dough and then extruding the dough into the necessary shape and drying. Other products are made by quick frying gelatinised potato pellets in hot oil. The pellets expand quickly to produce a potato puff product often with a hollow interior. There are also snack products which can be made in moulds and then fried or baked like biscuits: these include the pre-fabricated crisps. There has been a proliferation of such snack products

in recent years, particularly in the United Kingdom and the Netherlands, but also, to a lesser extent, in other EEC countries. The main ingredient does not have to be potato granules or flakes, as maize flour based snacks are also common. Like potato crisps these products are frequently flavoured. Various additives are usually included to improve or maintain the quality of the product.

Fried non-snack products

The third category of potato products is fried non-snack products. The most common product in this category is french fried potatoes which are sold either deep-frozen or chilled. The chilled product can be stored for three or four days at a storage temperature of between 4°C and 5°C, whereas the deep-frozen product can be stored for much longer at a storage temperature of between -18°C and -20°C. The potatoes are washed, peeled and chipped, and then blanched in hot water to partially cook the potatoes and to inactivate the enzymes which cause discoloration. They are then fried in hot fat or oil. In this process about 10 per cent of the moisture content of the potato is lost, a very much smaller proportion then occurs in the frying of crisps. The length of frying varies, depending upon the characteristics of the product required. Frying may be completed in one fryer or in two fryers in series. Then the french fries are frozen or chilled and packed ready for distribution. The product is finish-fried in the home or catering establishment immediately prior to consumption. Recently, french fries have been introduced into the European market which do not need to be finish-fried but can be prepared for consumption by heating in an oven.

In addition to french fries, there are a number of other products which include deep-frying as an important part of the manufacturing process. These include the manufacture of Rösti (made from grated potato), pommes parisiennes (small-sized potatoes which are deep fried whole), Reibekuchen (a German potato pancake made mainly from grated potato) and fried potato slices (scalloped potatoes). Most of these products will be deep frozen although a number of specialised regional products such as Reibekuchen are distributed in chilled form.

Non-fried frozen products

A small category of potato products includes those products which are cooked, but not fried, and then distributed in frozen form. These include products such as croquette potatoes, duchesse potatoes, potato cakes or fish cakes which comprise mainly mashed potatoes shaped into different characteristic forms (e.g. croquettes are cylindrical) and covered with breadcrumbs. Also included in this category are those products which include potatoes in pre-cooked dishes (such as cottage pies, a dish of minced meat and onion covered with mashed potato) and frozen dinners. The manufacturing process varies from product to product but would involve cooking, product preparation and freezing stages, although some of the products may be made from rehydrated potato flakes or granules.

Preserves

Another category of potato products include those potatoes which are preserved by bottling or canning or packing in an inert gas or vacuum. After the normal cleaning and peeling stages, the potatoes are put in the cans or bottles with water (often salted), and then sterilised and cooled.

The vacuum packed potatoes, which are common in France, are sterilised in a similar way and it is only the method of packing which distinguishes them from bottled and canned potatoes.

Other products

Finally there remain a series of products which do not fit very easily into any of the other categories. These include potato salad which is a commonly available product in several European countries, particularly West Germany. Two kinds of potato salad are available; the one available in Germany often includes other vegetables, herbs and some meat, whereas the North American and British potato salad is usually a mixture of mayonnaise or salad cream with potatoes, although other vegetables may be included to make a vegetable salad. Other miscellaneous products which contain a fairly high proportion of potato include a number of pies such as Cornish pasties (a mixture of potato, meat and other vegetables in a pastry crust). Again the potatoes used in such products may be dehydrated flakes, granules or potato pieces.

Despite the wide range of different potato products the potato processing industry is dominated by the production of a small number of major product groups namely potato flakes and granules (to produce instant mashed potato and snack products), dehydrated potato pieces (particularly for Klösse and Knödel), french fries, and crisps. Many of the other products are relatively insignificant in comparison to these and consequently this report will not focus upon them specifically.

SECTION III: POTATO QUALITY AND PROCESSING REQUIREMENTS

The potato

Despite the many hundreds of studies which have been conducted on the chemical composition of potatoes, Talburt, Schwimmer and Burr (Talburt and Smith, 1975) admit that "it is difficult to obtain a clear picture of the composition of the potato". That such a statement is true is not only due to the differences in method of analysis but also to the fact that there is quite considerable variation in the composition of potatoes according to degree of maturity, genotype and the environment in which the tuber is grown and stored. The influence of environment and genotype on the qualities of the potato will be discussed later, but first the composition of potatoes will be outlined in very broad terms, recognising that substantial variations can occur because of genotypic and environmental factors. As we will see later the choice of genotype and modification of environment (as far as that is possible) provide opportunities for processors to influence the quality of the raw material which enters the factory.

The tuber of a potato is made up of individual cells which are cemented together with chemical substances called pectins. The chemical constituents of the potato tuber lie either in the potato cell itself, or its lining of protoplasm, or in solution. Water permeates the whole organism and, with its dissolved contents, forms the cell sap. In fact, the composition of the potato tuber is largely water, comprising on average more than three-quarters of its total weight, although the level can vary quite considerably.

By far the biggest proportion of the dry weight of the potato tuber comprises starch in two major forms, amylose and amylopectin. These can account for between 60 and 80 per cent of the dry matter content. Potato tubers also contain a number of sugars and these can comprise between 0.25 and 10 per cent of the dry matter in mature unstored tubers. However, if stored under unsuitable conditions the total sugar content of potatoes can rise to almost one-third of the dry matter content. Nitrogen is also present within the tuber mainly as protein, free amino acids and basic nitrogen, including the alkaloids. Nitrogen comprises, in total, between 1 and 2 per cent of the dry weight of the potato tuber and nitrogen in the form of protein would comprise 0.15 - 1 per cent. The cell walls comprise mainly fibre and the amounts can vary between 0.2 and 3.5 per cent of the dry matter content of the potato tuber. Other important components include organic acids, enzymes, fat, pigments, vitamins and ash. Following Burton (1966), the principal constituents of the dry matter can be summarised as follows:

	Percentage in the dry matter	
	Range	'Normal' value
Starch	60 - 80	70
Reducing sugars	0.25 - 3[a]	0.5 - 2[a]
Sucrose	0.25 - 1.5[a]	0.5 - 1[a]
Citric Acid	0.5 - 7	2
Total N	1 - 2	1 - 2
Protein N	0.5 - 1	0.5 - 1
Fat	0.1 - 1	0.3 - 0.5
Fibre	1 - 10	2 - 4
Ash	4 - 6	4 - 6

[a] for mature unstored tubers.

The potato is often much maligned in nutritive terms when in fact it makes a very valuable contribution to Western European diets. The potato provides significant quantities of protein, vitamin C, carbohydrates, iron and to a lesser extent vitamins of the B complex and vitamin A.[1] The manufacturing processes do not seem to reduce significantly the level of vitamin A but vitamin B1 and vitamin C content can be quite seriously reduced in cooking as they are water soluble and are liable to be leached out. In recognition of this, vitamin C is sometimes added to dehydrated products so that their nutritional value is not reduced too drastically. Protein levels do not seem to be affected by the various manufacturing processes. The main nutritional contribution of potatoes is in terms of energy and this is not affected by the various manufacturing processes, indeed those products which are fried have an increased calorific value although the additional calories are not necessarily a desirable feature. Whilst potatoes which have been processed may not have the same nutritive value as raw potatoes, the nutritive value is unlikely to be reduced more than potatoes prepared by boiling.

Potato qualities which are important to processors

As far as potato processors are concerned, certain compositional characteristics of the potato have an important bearing upon its suitability for processing as well as a number of external features. Both the 'internal' and 'external' qualities required by processors will now be considered.

As was seen in the previous section, the manufacturing of certain important potato products involves the drying or frying of potatoes. In both of these processes water is released from the potato tuber. For dehydrated products this can result in a reduction in the weight of the final product to roughly one-sixth of the weight of the fresh potato and for fried products the weight can be reduced to one-quarter (in the case of crisps) and one-half (in the case of french fries). Consequently, the processors of these kinds of products prefer to utilise potatoes with a relatively high solids content since, with such potatoes, the yield of final product is much greater per unit fresh weight. Adler (1971) notes that for dehydrated products a 1 per cent increase in dry matter content of the raw material increases output by 1 kg per 100 kg of peeled potato input. However, high dry matter content is often (but not always) associated with greater mealiness after cooking and consequently high dry matter content potatoes are not appropriate for canning or bottling as the potatoes have a tendency to disintegrate in the containers. Although dry matter content is not the only factor associated with the consistency and texture of the product it appears that low dry matter content seldom leads to good consistency of dehydrated or fried products. Apart from the desire to obtain good yields, it is often claimed that certain aspects of the quality of fried potato products are associated with high dry matter content. Crisps made from high dry matter potatoes retain less oil and french fries tend to be crisper, less oily and have a better appearance and flavour (Adler, 1971; Talburt and Smith, 1975).

---

[1] A recent publication in the British Medical Journal advocated greater consumption of potatoes in the United Kingdom (see "Prescription for a better British diet": Passmore, R., Hollingsworth, D.F., and Robertson, J., British Medical Journal, 1979, Vol. 1, pp.527-531).

Despite the importance of dry matter content and the desire for this to be as high as possible to increase yield, a processor will not necessarily procure the highest dry matter content potato. Often very high dry matter content potatoes produce an unsatisfactory textured product and high solids may also be associated with a number of other qualities which are not wanted by the processors. For example, some high dry matter content varieties may have high reducing sugars or be vulnerable to blackspot damage. The choice of the processor will also be affected by price relationships, for whilst an ideal high dry matter content potato may be available, some processors might opt for a lower dry matter content potato if it can be bought at a lower price. In this case the processor will be weighing the lower yield of product, probable (although not necessarily) poorer product quality, and probable higher processing costs against the lower raw material procurement cost. Obviously the scope to buy cheaply is also limited by product quality considerations although there may be greater possibilities in some processing sectors than others. The processor's raw material requirement must therefore be viewed pragmatically for the ideal potato variety for processing does not exist and probably never will. The processor will therefore be forced to accept potatoes which, though good in many respects, are not ideal.

As far as potato processors are concerned another important component of the potato tuber is the level of sugars, particularly the reducing sugars (glucose and fructose). Although the sugar content of potatoes is relatively small they do have important influence on the quality of some processed products. Potatoes high in sugars have a characteristic sweet taste and can have a poor texture after cooking, although this is most likely to be related to the low starch content associated with high sugar content (Talburt, Schwimmer and Burr in Talburt and Smith, 1975). However, as far as product quality is concerned, sugar is most closely associated with its affect on the colour of the final product. In the manufacture of crisps and french fries the colour of the final product is closely associated with the level of reducing sugar in the raw material as is the level of scorching of dehydrated products during manufacture and the darkening which may take place during their storage.

In the past, the colour of fried products was considered to be a result of caramelisation of the sugars in potatoes, but more recently, research workers consider that the principal source of browning during and after processing results from the Maillard or non-enzymic browning reaction. This is a reaction between certain groups of reducing sugars and the free amino groups of the amino acids, and perhaps to a lesser degree, the proteins of the potato. The correlation between reducing sugars and browning is by no means perfect which suggests that there may be other, as yet, undiscovered factors at work. However the relationship is good enough for most processors who want to avoid excessive browning of products during processing and storage, to avoid purchasing raw material with high levels of reducing sugar.

In addition to the browning associated with the manufacturing process there is another source of discoloration resulting from a natural enzymic reaction. Enzymic browning occurs when potatoes are cut, peeled or damaged in any way. This is due to the oxidation of phenolic compounds (particularly the amino acid tyrosine) by phenolase and the resultant formation of the black pigment melanin. As potatoes need to be peeled before most processes this enzymic reaction can cause difficulties for

processors. There are a number of ways of overcoming the problem but the most common is the addition of substances which reconvert the quinones formed by the action of the enzyme to the original polyphenols.

Another form of discoloration which can affect the potato occurs after any form of cooking and is referred to as 'after-cooking discoloration'. Although after-cooking discoloration does not affect flavour or nutritive value it can seriously affect appearance and therefore can be quite a problem for manufacturers of french fries, dehydrated potatoes and preserves. It results from the formation of a complex of chlorogenic acid and iron during cooking which is oxidised on cooling. Again, this type of discoloration can be delayed, prevented, or in some cases reversed by treating the potatoes with one of a number of chemicals, although, ideally, processors would prefer to purchase potatoes without the tendency for enzymic oxidation or after-cooking discoloration.

The texture of the cooked potatoes seems more likely to be linked to the structure of the potato tuber than directly to its chemical composition, although this is an area over which there still remains much uncertainty. Indeed there is still some dispute over the precise mechanism causing potatoes to disintegrate (Gray and Hughes, in Harris, 1978). It is known that when the temperature of a potato is raised above a certain level, water moves from the non-starchy parts of the potato cell into the starch granule which then begins to swell. At even higher temperatures the starch begins to gelatinise. In some potatoes this causes cells to separate and this produces a 'sloughing' or disintegration of the potato. The precise reasons for this are not agreed and although high dry matter content has been shown to be related to flouriness or mealiness, this has not always been found to be the case. A floury texture is preferred for the manufacture of potato granules and potato flakes, as in this case cell separation is more easily achieved and the risk of ruptured cells reduced. When the cell is ruptured the gelatinised starch escapes and results in a sticky product (such as was found in pre-World War II products), although Gray and Hughes (in Harris, 1978) suggest that other factors could also be important.

The colour of the flesh of the fresh potato used for manufacturing processed products has an important affect on the appearance of the final product. There is apparently a strong correlation between the carotenoid content of the potato tuber and its flesh colour (Burton, 1966). The greening of potatoes, which is due to the formation of chlorophyll when tubers are exposed to light, can also have a serious effect on the appearance of the final product, and is undesirable because of its associated toxicity.

In addition to the chemical composition of the tuber a number of morphological features of the potato are important as far as processors are concerned. These features, most of which are external to the tuber, include the size and shape of tubers, the absence of deep eyes, and the absence of any external or internal damage.

The size of the tuber is particularly important for some processors. For the manufacturers of french fries only larger tubers are required as this maximises the yield of good quality french fries from any given tuber. Size of tuber can also be important in the manufacture of crisps, for large potatoes produce crisps which are difficult to pack in some of the smaller packets which are on sale. Also small tubers are undesirable

as they produce small unattractive crisps. Only small sized potatoes are required for canning or bottling as larger potatoes provide a poor fill of the containers and are not as attractive in bottles. Size of tuber is far less important in the manufacture of dehydrated potatoes as the final product does not resemble the shape of the fresh tuber. However, tubers which are too small are not desirable as peeling losses are high.

A uniform shaped tuber is desirable for a number of reasons. It reduces the level of peeling losses, increases yield of product and improves the appearance of the final product, especially of french fries and crisps. For the same reasons deep eyes are not desirable. The desired shape of the tubers varies a little depending upon the type of product being manufactured but generally round or oval shaped potatoes are preferred, again because peeling losses are reduced and appearance improved.

Damage caused by any form of disease or bad handling is undesirable as it usually involves higher peeling or trimming costs to maintain a good quality product. In many cases disease can render the tuber completely unfit for processing. Tuber damage which is superficial is usually easily removed by peeling and hence is of little consequence. Particularly common forms of damage are those caused during harvest and transport, and some tubers are more susceptible to this than others, depending on varietal or environmental factors. Internal bruising (blackspot) can be considered a major problem for the industry and its results from enzymic oxidation (in the same way as peeled tubers darken) of cells which have been damaged because of stress of one kind or another. No external signs of damage are visible and the precise factors causing blackspot have still to be fully evaluated.

Another problem for processors is glassiness caused by secondary growth of the tubers. This causes very serious quality problems as the tubers which result from secondary growth are partly formed at the expense of the first formed tubers. They have a very poor texture and very low dry matter content. This results if temperatures are consistently very high and/or too much nitrogen is applied particularly if for any reason there has been any check in growth. This defect was a major problem in the drought years of 1975 and 1976.

The peelability of potatoes is an important characteristic as far as processors are concerned. Some potatoes with thick skins can be very difficult to peel; however a thick skin can also prevent excessive damage because of bruising. The colour of the skin can also affect the appearance of a product particularly in the crisp sector where the potato is usually only partially peeled.

To all the separate aspects of quality mentioned in this section which are important to processors it is necessary to add the need for uniformity of quality. For the processor attempting to control the quality of the final product great difficulties can be introduced if he is constantly having to adjust his process to maintain quality. Whereas uniformity of quality is impossible to guarantee with a raw material like the potato anything which reduces quality variation is attractive to potato processors.

It has been the purpose of this section to highlight those general qualities of the potato which are important to the manufacturers or potato

processors. The specific requirements of the manufacturers of different types of potato products will be discussed in more detail in later sections. The factors affecting these qualities will now be considered, giving some idea of the potential to influence quality.

The control of potato quality

The raw material requirements of potato processors are dictated by their desire to maximise yield of finished product, avoid extra processing costs and maintain product quality standards. For example, raw material which has a low dry matter content reduces the product yield per unit weight of potatoes, damaged potatoes increase trimming costs and high sugars can result in an unacceptable quality of product unless more expensive processing methods are adopted. The processor is naturally reluctant to accept raw material which does not meet his requirements unless the price is reduced to cover the extra direct or indirect costs which are incurred. Because of its importance to the processor and its variability, potato quality for processing has become an issue upon which a lot of attention has been focussed and relations between processors and their raw material suppliers have occasionally become strained. Relationships are not made any easier by the wide range of factors (some of which are not fully understood) which combine to modify tuber quality from year to year.

This section reviews the factors affecting quality. Recognising that quality is determined by genotypic and environmental factors, the processor (or his supplier) has some opportunity to influence the quality by specifying the variety of potato, choosing potatoes grown in a particular location or on certain soils, or specifying producers' cultural practices or storage procedures. Each of these options may be affected by climatic factors, in which case he may lose some influence over quality, although certain varieties and locations may be less seriously affected by climatic factors and certain cultural practices can modify their impact. As an important last resort, certain aspects of raw material quality can be modified in the manufacturing process. The technology available for processing and the use of certain chemicals provides the facility for the effects of some deficiencies of raw material to be reduced, and an element of control over quality to be exercised. Control over quality therefore begins with the selection of the raw material and extends right through the manufacturing process. Because of the costs of control during manufacture, emphasis has usually been placed on maintaining as high a level of raw material quality as possible and this represents one of the major problems of processors.

As was seen in the previous section, there are several quality factors which are important to the processors. The most important are a reasonably high dry matter content, low susceptibility to enzymic oxidation and after-cooking discoloration, low reducing sugar content, good tuber form and shape, an appropriate size of tuber, absence of tuber damage or disease, suitable flesh colour and good texture. The factors affecting these will now be considered in turn, although because of the wide range of influences there is occasionally disagreement on the importance of certain factors. The author has relied heavily on the findings reviewed in Burton (1966), Talburt and Smith (1975), Adler (1971), Howard (1974), Hughes (1974), and Gray and Hughes (in Harris, 1978), and Burton (in Harris, 1978).

The dry matter content of potatoes can vary quite considerably between varieties, and consequently, by choosing appropriate varieties processors have a relatively straightforward way of ensuring that their yield of final product is maintained. However, levels of dry matter content for any given variety can be affected by cultural and environmental factors, although it is usually recognised that the modification of dry matter content by these factors is small (Gray and Hughes, in Harris, 1978). The precise effect of climatic factors such as water supply, temperature and radiation on dry matter content is not clearly understood, although in temperate climates, warmer, sunnier years with long growing seasons will increase the dry matter content (Gray and Hughes, in Harris, 1978). The fertilisers N and K can reduce dry matter content over the range of manuring to give optimum yields (Smith, in Talburt and Smith, 1975; and Gray and Hughes, in Harris, 1978), although it must be added that the influence of other environmental factors may influence the results. The effect of P is less consistent and in some circumstances has been found to increase dry matter content. Irrigation during the early stages of growth also increases dry matter content but later in the growing season can lead to a reduction in dry matter content. Because mature plants have a higher dry matter content than immature plants the date of planting is an important factor affecting dry matter content. The influence of soils can also be very important because they vary the exposure of the potato to water, air, temperature, and nutrients.

It will be recalled that there are three distinct types of discoloration: first, discoloration of peeled, cut or damaged raw potatoes because of enzymic oxidation in the damaged cells when they are exposed to air; second, after-cooking discoloration; and third, non-enzymic browning as a result of high temperature cooking.

The discoloration of raw potatoes as a result of enzymic oxidation is directly correlated with the concentration of tyrosine in the cell sap (although other factors may play a part). The level of tyrosine appears to vary from variety to variety, and those varieties with high levels are consistently prone to enzymic discoloration and those with low levels appear to be relatively free of this problem. Gray and Hughes (in Harris, 1978) point out that some varieties with intermediate levels of tyrosine are difficult to categorise and in these varieties environmental factors or cultural practices could be more critical in determining vulnerability to this form of discoloration. Both climate and soils can be important, although the former is likely to be more important. Of the nutrients, only the level of K has been found to have any affect on the level of tyrosine (particularly when in the form of KCl). When K is low however, N levels may have an effect. It has also been observed that storage practices can increase the level of tyrosine in the tuber although these are relatively insignificant. Enzymic oxidation of the raw tuber only becomes a problem when processors have a long delay between peeling and processing. However, controlling enzymic oxidation in the factory is relatively straightforward, involving either holding peeled potatoes under water or in a weak solution of sulphur dioxide. Consequently this form of discoloration is a relatively minor nuisance for processors and control is achieved by measures taken in the factory.

After-cooking discoloration can be influenced by a wide range of factors. It is affected by variety, soils, fertilisers and season. Differences between varieties are largely due to varying amounts of chlorogenic acid and citric acid although the latter is less important.

When the level of chlorogenic acid is high there will be after-cooking discoloration and when low this form of darkening is likely to be absent. Similar to the effect of tyrosine, varieties with intermediate levels are more influenced by environmental conditions and cultural practices. The role of different levels of iron in the tuber is not known, although some suggest it could play a part in the after-cooking discoloration process. After-cooking discoloration has been reported to be higher in those soils with insufficient K and the same has been found in soils with a higher N/K ratio although this may not always be the case. However the precise way in which P and K affect this kind of discoloration is still not fully understood. Low pH soils seem more likely to produce potatoes which darken. It also seems that potatoes blacken more in cool, wet years because of higher levels of chlorogenic acid in the tuber. Immature potatoes are also more prone to this form of discoloration than mature.

The problem of after-cooking discoloration can be serious for the manufacturers of dehydrated products and french fries. Again some control can be achieved in the factory by the application of chemicals (e.g. sodium acid pyrophosphate (SAPP)) which have been found to react with iron and prevent after-cooking discoloration. Citric acid also reacts with metalic irons to prevent discoloration.

It has been noted that potatoes high in reducing sugars content cause excessive browning of french fries and crisps, and darkening of dehydrated potato products both in manufacture and in store (non-enzymic browning). The levels of sugars in the potato tuber are constantly changing throughout the growing season. In very immature potatoes the level of sucrose is higher than reducing sugars (glucose and fructose). With maturity, sugar levels fall but sucrose falls at a faster rate so that at harvest sucrose and reducing sugars are at a similar level although this may vary between varieties. The level of sugars in the tuber at harvest has been shown to be affected by variety, maturity and environmental conditions. The level of sugars at harvest differs quite considerably between varieties as does the rate of sugar accumulation during storage. The immature potato not only has a higher reducing sugar content but also has a high sucrose level which affects its behaviour during storage, for during storage immediately after harvest excess sucrose is converted into reducing sugars. There are relatively few environmental factors influencing the level of sugars. It has been found that lower soil temperatures (below $10^{o}C$) at harvest are likely to increase reducing sugar content and also that high levels of nitrogen may increase levels of reducing sugars whilst potassium may reduce it, although some research workers have found that fertilisers have no effect. It has been noted that spraying for weeds, and pests and diseases can increase sugar content although this is probably associated with the relative immaturity at harvest of the weed, pest and disease controlled plants.

Within the potato tuber during storage there are continual conversions of starch to sugar, one form of sugar to another, and of sugar into starch. The principal factors which influence the accumulation of sugars during storage are variety and temperature. There are two separate sugar accumulating effects when potatoes are stored. Potatoes stored at harvest temperatures will maintain sugar levels for some months and then begin to sweeten at an increasing rate. This so-called senescent sweetening starts later the lower the storage temperature and is irreversible. A second type of sugar accumulation occurs at low temperatures and consequently is known as low temperature sweetening. This kind of sweetening is to a

large extent reversible if the temperature is raised for a three or four week period (a procedure referred to as conditioning). Storage practice for processors' requirements often involves a compromise between delaying senescent sweetening at the expense of incurring some low temperature sweetening which can be partially reversed by a period of conditioning (Burton, in Harris, 1978).

In general terms there is comparatively little evidence that sugar content can be very significantly modified by such factors as fertiliser, location, soils, irrigation etc. and the most important influencing factor is variety, the maturity at harvest and, of course, the storage regime.

There are several ways in which potato processors can control the level of non-enzymic browning by procedures in the factory. The peeled potatoes can be subjected to chemical treatment which extracts the main constituents which cause the browning reaction. In particular sulphiting (the adding of sulphite in the form of either sodium sulphite, sodium bisulphite or sodium metabisulphite as a source of sulphur dioxide) partially blocks the browning reactions and allows the use of higher temperatures during frying or dehydration. Alternatively hot water blanching may be used to leach out the reducing sugars which are responsible for the production of poor colour. In some circumstances when sugar levels are low or when uniform colour is required the hot water blanching procedure is followed by immersion in a glucose bath which can add back the required amounts of glucose to the cut or sliced potatoes to provide even greater control of crisp colour.

Colour can of course be modified by varying frying time and temperature. However in order to obtain both a good texture and a good colour under the same frying conditions the sugar content must be below a fairly low maximum level so that an acceptable product is manufactured. If reducing sugars were too high then good colour would be achieved well before the crisp had been completely fried; the same would apply to french fries.

A crisp manufacturer has other ways in which he can modify crisp colour. When a crisp is fried, very little browning takes place during the initial period of frying when the moisture content of the potato is being reduced from over 70 per cent down to 6 to 10 per cent. After this point, the rate of browning is accelerated as the reducing sugars are more concentrated in the crisps. If at a moisture content of 6-10 per cent the crisps are removed from the fryer and the moisture content is reduced further by drying there is some reduction in the browning reaction. One way of conducting this final drying has been through using microwave ovens which also produce crisps with a lower oil content. Alternatively a vacuum fryer process can be used. This method utilises a conventional fryer down to a moisture content of 6-10 per cent when the colour development is just beginning. Then frying is completed under vacuum at high temperatures and no further colour results.

In addition, the crisp manufacturer is given some flexibility in utilising potatoes with higher sugar content simply by virtue of the demand for flavoured crisps. In many parts of Europe the principal flavour is paprika and when such a spice is added to the crisps it gives the product a darker colour. Consequently, it is possible for manufacturers to route darker crisps for flavouring.

3)

The remaining qualities are largely predetermined by genotypic factors and hence choosing specific varieties is the main method of control. This applies particularly to flesh colour, peelability, tuber size (although some measure of control over size is achieved by varying the plant population) and the depth of eyes. Tuber shape and form are also largely varietal characteristics, although they can be influenced in some varieties by cultural and environmental conditions which favour rapid and sustained growth. Likewise, uniformity of tuber shape is principally affected by variety and plant spacing although there is some evidence to suggest that it is also controlled by temperature. It should be added that flesh colour can be controlled in the production of potato granules and flakes by the addition of colourings, although in practice this only applies to those countries where white fleshed potatoes predominate and a yellow colour is added.

Factors affecting texture are probably those which are subject to most scientific controversy. There are several views as to which factors influence texture. It is understood that texture results from an interaction of variety, maturity and environment. Gray and Hughes (in Harris, 1978) conclude that many of the factors are determined genetically by the precise growth pattern of the tuber, and consequently the most consistent differences in texture are produced by variety, maturity and plant spacing. They suggest that "the effect of climate, site and fertilisers on texture are often less consistent and more difficult to predict possibly because of the complex interaction of environmental components on the growth pattern of the tuber". Texture is particularly important to the manufacturers of potato granules and flakes although the addition of emulsifiers provides some control over the texture of the final product.

It is not intended in this report to expand on the methods of controlling damage caused by mechanical impact, pests or diseases. The subject is large and the extensive literature is reviewed elsewhere. Suffice it to say that mechanical damage can be controlled by attention to detail at harvest and during all handling stages and that a measure of control over pest and disease damage can be achieved by sound husbandry practices and the purchasing of healthy seed.

Internal bruising (blackspot) deserves a little more consideration as it is a very serious problem for some processors. The susceptibility of a potato to blackspot depends not only on the presence of the chemical constituents which might cause the darkening but also on the susceptibility of the potato tissue to damage, for only when cells are damaged does a chemical reaction take place to form discoloration in the tuber. It is understood that the susceptibility of a potato to blackspot depends to a large extent on the cultural practices of the farmer, growing conditions, storage conditions and the tuber temperature during transport and preparation. Although the precise mechanisms at work are not completely understood it has been found that susceptibility to blackspot is generally less when higher levels of potassium are applied and when dry matter content is lower. The current advice given to Dutch farmers who have problems with blackspot suggest that the application of K affects the strength of the tissue comprising the individual potato cell and consequently makes the tissue more resistant to damage. We have already seen that processors generally require a fairly high dry matter content in their tubers and consequently control of susceptibility to blackspot by reducing dry matter content is only undertaken where blackspot is a

major problem. It is known that blackspot tends to be an even greater problem during very wet or very dry years as this affects the susceptibility of the internal tissue to damage. It has also been noted that susceptibility to blackspot can be influenced by the size of the individual potato cells although there is very little that the farmer can do to affect this.

It is well known that blackspot susceptibility increases with storage. This is probably linked to the loss of moisture when in storage which reduces the turgidity of the tuber, and consequently careful attention should be paid to control of ventilation during storage. The incidence of blackspot is quite markedly reduced if the temperature of the tuber is increased immediately before they are moved or graded. This provides farmers, wholesalers and processors alike with a very positive method of reducing possible damage from blackspot. The minimum temperature of 12°C is recommended and even higher temperatures (15-20°C) if it is known that the potatoes are very blackspot susceptible. The warming up period has to begin well in advance of transport, say 2 or 3 days before and some allowance must be made for cooling during the physical movement of the tubers. It should also be added here that careful handling of tubers is another very important consideration and there is a wide range of different ways in which damage to the individual cells of the potato can be avoided. It appears that some varieties are more susceptible to blackspot damage than others although the reasons for this are not fully understood. The choice of variety therefore does provide some control over the susceptibility to blackspot.

Glassiness, caused by secondary growth of the tuber, can be controlled by irrigation and by ensuring that all the tubers are well covered by earth. Manuring with excessive quantities of nitrogen must also be avoided.

One quality characteristic which has so far been ignored is flavour. This is a notoriously difficult concept and there has been relatively little research work on it. Like most components of quality it is determined by genotype and environment although there is some evidence that variety may be more important.

From the foregoing it is possible to see that there is a wide range of factors influencing the quality of the raw material used in factories manufacturing potato products. The manufacturer can improve his chances of getting the raw material he requires by specifying variety or insisting upon certain cultural or storage practices being undertaken. He also has the facility to apply certain procedures within the factory which enable him to overcome some features of the raw material which might represent a problem. However the potential for controlling raw material quality must be seen in the context of the circumstances of the manufacturer. For example, the raw material procurement policy might be shaped by the nature of the potato marketing system of the country in which the factory is located or by the specific problems of individual potato procuring businesses. The following sections will illustrate that some organisations are quite content to leave the responsibility for raw material quality to their suppliers, whereas others take this responsibility on their own shoulders, either by attempting to influence the cultivation of the crop by farmers, or in some situations, growing their own potatoes. The general problem of the procurement of raw material supplies will be considered in the next section within the general context of a review of the most important aspects of the potato processing businesses.

SECTION IV: IMPORTANT ASPECTS OF THE BUSINESS

The specific situation of processors in each of the nine Member States and in particular the patterns of procurement adopted for obtaining the necessary raw material will be discussed in some detail in each of the separate country chapters. This section will deal in very general terms with some of the major problems of processors and will provide an indication of some of the ways in which these problems are overcome in the different countries. In any area of activity it can be dangerous to generalise because inevitably certain specific factors may have influenced the way in which individual organisations operate. However, there are a number of common themes which can be described and these and the various approaches adopted serve as a basis for describing the European potato products sector, in so far as it can be described as a single industry. The purpose is to give some insight into the nature of the potato processing business. Each of the major forms of potato processing will be dealt with separately because, on the whole, within all the Member States there has been a tendency for separate development of each of the potato processing sectors as was indicated in the first section of this report.

This inherited structure of the industry represents a major problem in itself for there are a number of advantages in operating integrated plants which produce a range of products from the raw material. The problems of single product factories are magnified when a specific variety is used which has little market value outside that sector. For example, in the United Kingdom crisp sector, only tubers over 40 mm of the variety Record are used and the remainder of the crop is difficult to dispose of commercially. The same happens in West Germany where the variety Saturna is used.

The concept of integrated potato processing plants has a logical appeal, for the raw material requirements of the different processes complement each other and there is every opportunity for much of the rejected or waste material from french fries and crisps to be utilised in the dehydration process. However, in order that such advantages in terms of raw material should not be achieved at the expense of quality of the final product, a variety must be available which is suitable for all three processes. The only variety which is used for all three utilisations in Europe is Bintje but even that variety is sometimes considered slightly less than ideal for crisping. Consequently a fully integrated plant involving all three major forms of processing may well have to compromise a little on quality. In practice it is french fry and potato flake manufacture which best complement each other although there is one European example of an integrated plant involving all three major product groups.

It is easy perhaps to overstate the advantages of integrated plants in view of the availability of very competitively priced dehydrated products from integrated North American plants. However, in Europe different circumstances operate. We have seen already that historically the product markets have developed at different rates and this has been a major factor contributing to separate development (and it might be added that the different rate of development of the separate markets might cause problems in the future for integrated plants). But in addition to this, the marketing systems have evolved in different ways to suit different circumstances. For example, in the Netherlands, where a multi-purpose variety is available, the sorting function takes place at the wholesale level because a major part of the crop is required in the ware market. Consequently, in the

circumstances of the Netherlands, the extra costs involved in sustaining a non-integrated potato processing industry are minimised, although perhaps there is less potential for extracting full value from the waste incurred in the french fry manufacturing process through diverting it to dehydration. In other EEC countries either the absence of good quality multi-purpose varieties or the uneven development or small scale of the processing industry has also restricted the opportunities for the introduction of integrated plants. There are five examples of integrated plants broadly operating on North American lines in the EEC. Two factories are operated in the United Kingdom by one company, and there is a single factory in Belgium, France and Italy.

However, the relative scarcity of integrated plants on North American lines does not mean that most European processors have not faced up to the problem of fully utilising the raw material which they purchase. For example, in West Germany it is common for products like potato salad to be produced in the same factory as french fries from the smaller potatoes, slivers (thin strips) and nubbins (broken or short pieces). Indeed, there are a number of ways in which the french fry manufacturer can utilise most of the offcuts but a dehydration line (usually producing potato flakes) is an extremely flexible and convenient method.

The issue of integrated plants has been brought to the fore within the European potato processing sector by the spectre of competition from the North American dehydrated potato sector. It is often suggested that the major reason for competitive prices from North America is the production of dehydrated potato products from unwanted material from the other processes. Although this is an over-simplified analysis, it is certainly one which is receiving fresh consideration and it seems likely that in Europe the future will see more emphasis on integrated plants for the extraction of even greater value from the raw material which has been purchased, although the potential for such a development varies from country to country.

THE CRISP MANUFACTURER

The crisp manufacturer has a wide range of problems in running his business. As is the situation with all potato processors, the procurement of raw material is a major concern. Although the proportion of total costs which is represented by the raw material is lower for crisps than for the other potato products, potatoes still represent one of the major cost elements. He has to procure raw material with certain specific characteristics, in particular with a high dry matter (for yield) and low reducing sugar content (for good colour). Once the raw material is obtained the basic manufacturing process is fairly straightforward although constant control of quality is necessary throughout the process. Once the product is manufactured there is the problem of distribution. The shelf life of crisps is relatively short and the distribution of the product represents a very major challenge to all crisp manufacturers. It is perhaps no coincidence that a number of the principal European crisp manufacturers are also important manufacturers of biscuits and other snacks as the distribution problems are very similar and crisps complement the biscuit range. The market for crisps is dominated by brands and scale of operation is important in order to sustain the branding operations. Consequently the sector is characterised in most European countries by a very small number of firms dominating the market. In some countries the growth of the market has slackened quite considerably in recent years putting greater emphasis on the marketing function.

The major manufacturers in West Germany are Bahlsen/Flessner and Funny-frisch; in France, Flodor and Vico; in Denmark, the Danske Spritfabrikken; in the Benelux countries, Smiths, Golden Wonder and Westimex/Croky Chips; in the United Kingdom, Smiths, Golden Wonder, Walkers and United Biscuits; in Italy, Pai Alivar and San Carlo; and in Ireland, Tayto and Smiths. These companies hold a dominant position in national markets of the EEC, although because the size of the markets varies quite considerably so does the size of these organisations. By far the largest quantity of crisps is manufactured in the United Kingdom and in that country per capita crisp consumption runs at much higher levels.

Raw material procurement

In very broad terms it is possible to generalise about the requirements of the crisp processors in the different European countries. They want a high dry matter content potato, usually in excess of 20 or 21 per cent and ideally as high as 24 or 25 per cent, as this will ensure a reasonable yield and a lower consumption of oil. The tubers must be uniform in shape with shallow eyes. The level of reducing sugars should be less than 0.25 per cent although in some countries the preferred level is much lower than this, at around the 0.1 per cent level. The minimum tuber size should be 35 or 40 mm, depending on the requirements of the particular organisation. In some countries, where sales of small bags are predominant, a maximum size may also be introduced to avoid problems during packaging. Crisps which are too large are undesirable as they can give an unsatisfactory fill of packets and can cause losses through overfilling. They are also more liable to fracture during distribution which spoils presentation. It goes without saying that the potatoes should be without external damage which might lead to large losses by manufacturers. These external defects include mechanical damage and defects resulting from diseases of the tuber. Yellow fleshed varieties are used throughout Europe although the principal reasons why these varieties have been chosen is because of their dry matter and sugar content rather than flesh colour. Manufacturers would also prefer the potatoes not to have any tendency to discolour because of enzymic oxidation or after-cooking browning, although there are relatively straightforward methods for controlling these defects.

In terms of raw material requirements the year can be divided into periods. First there is the period during harvest of maincrop potatoes when potatoes are being moved from the field into stores. During this period processors are also taking potatoes fresh from the field for processing. The second period comprises the main processing campaign from the end of harvest throughout the winter months, and is based upon stored potatoes. The third period comes during the summer months. During this period the raw material from the previous harvest may continue to be drawn from special stores for processing but at some stage a switch-over is made to potatoes from the new crop, either domestically produced or imported.

The period during the summer months is a difficult one for crisp manufacturers. As we have seen in the previous section, potatoes accumulate sugars during the storage period. Consequently conventionally stored potatoes prove to be unsuitable for crisp manufacture during the summer months when temperatures rise. Added to this, the crisp manufacturers are reluctant to switch over to early potatoes when they have become available because immature potatoes tend to have a higher sugar content and are also much lower in dry matter content and consequently both colour of crisp and yield of product are adversely affected.

The policy adopted to overcome this difficult period may vary from company to company but it will normally comprise the selection of a variety which does not accumulate sugars at a fast rate throughout the storage season and storage at a temperature which avoids a high degree of senescent sweetening but which may cause a degree of reversible low temperature sweetening. To achieve the correct storage environment, it is necessary to refrigerate to maintain the low temperatures during the early summer months and to carefully control humidity to prevent water loss. The application of sprout inhibitors will also be necessary to prevent sprout growth during the period of conditioning at higher temperatures immediately prior to processing. To invest in the necessary storage to keep potatoes in the best possible condition through the storage season and into the summer months can be very expensive and the processors have to decide whether or not they consider it is worthwhile. A compromise policy is usually adopted with storage regimes taking the processors well into the early potato season and then switching over to early potatoes when their price falls to reasonable levels. During such periods the processors will be adopting the processing techniques outlined in the previous section to control the levels and effect of high reducing sugars. In some countries, crisp manufacturers switch over to the new crop before local supplies are available at an economic price. These may be imported from Mediterranean countries and may often be of better processing quality than domestic early supplies because they will have reached a later stage of maturity and consequently have higher dry matter content and possibly lower sugar levels.

The maincrop varieties used and the methods of procurement during the main processing campaign can be considered on a regional basis. Procurement policies for potato processors in that part of continental Europe where the Bintje variety predominates, tend to differ quite significantly from other areas. The Bintje area covers the Netherlands, a large part of Northern France, Belgium/Luxembourg and Denmark. Italy grows a wide range of varieties but is also supplied through part of the processing season from Bintje producing countries. Bintje is a potato which is extremely flexible in terms of its utilisation and although it is not the ideal potato for each form of processing it provides an acceptable product. In those areas where Bintje is the principal potato on the ware market and the preferred variety for french fry manufacture, it is usually widely available for crisp manufacture and normally it is more expensive and difficult to procure other varieties. Most of the crisp manufacturers in these areas have continued to utilise Bintje for the major part of their requirements although its shortcomings for crisp manufacture are widely recognised. The price of using Bintje is the generally higher sugar content, although this need not be a serious problem for it seems that consumers in these countries have come to accept, and now probably prefer, slightly darker coloured crisps. In any case, as we have seen, there are a number of actions which the processor can take within the factory to modify the level of colour, with one company making extensive use of vacuum friers. Also, fortunately, there is within some of these countries a significant demand for paprika flavoured crisps for which colour is less critical. Recently, Saturna has become increasingly popular as an alternative to Bintje because of its lower sugar levels and high dry matter content, in addition a range of other varieties are utilised for processing during the earlier part of the season.

In West Germany the procurement policies of the two major crisp manufacturers vary very slightly. The manufacturer located in the west of the country is well within the boundaries of 'Bintje Europe', and consequently could purchase suitable quality Bintje potatoes from the Netherlands if it

was required. However, there is a strong preference in West Germany for a lighter coloured crisp and consequently Saturna is preferred, and the use of Bintje is limited to a number of very specific circumstances. Supplies of Saturna are procured on contract from local growers although Dutch wholesalers also supply a significant proportion of the requirements. Saturna is also the principal variety for the manufacturer located further to the east of the country. Other maincrop varieties used include Juliver and Erntestolz. As there are no other suitable varieties freely available on local ware markets and as the locations are well outside the range of Dutch Bintje, the manufacturer has had to build up his sources of raw material from local farmers through producer groups.

The crisp manufacturers of the United Kingdom are similarly placed to those in parts of West Germany, in the sense that no varieties which are suitable for crisping have been readily available on the ware market. Consequently, the United Kingdom crisp manufacturers have to generate their own supplies of the varieties which they require. All major crisp manufacturers utilise Record, which like Saturna is a high dry matter, low sugar content variety. The crisp manufacturers of Ireland are in a slightly different position; for whilst they also depend almost exclusively on the variety Record, there is a general ware trade in that variety. The tastes of the Irish potato consumer are for floury high dry matter content potatoes like Record and when this variety was introduced at the beginning of the 1960s to supply industrial starch factories, it quickly established a place for itself on the Irish ware market. However, because the quality of potatoes coming onto the Irish ware market has been very variable, the crisp manufacturers have had to resort to direct contract growing to obtain their supplies, although they are not faced with problems of selling that part of the crop which they do not want, on the ware market.

A large proportion of supplies purchased by crisp manufacturers are obtained on a contractual basis. This is necessary to ensure continuity of supplies in those countries where the potatoes utilised are the same as those on the ware market, and where this is not the case contracting is essential to ensure that the right varieties are grown. In both cases contracts also give the processor greater control over the quality of the raw material he is seeking to procure. In addition, contracts enable manufacturers to budget ahead and reduce their risks. This latter facility is particularly important in those countries where they are using varieties found on the ware market, where raw material prices are often very variable and the product sold in a market which is very price sensitive. Because of this, crisp manufacturers are not in a position to alter their product prices to reflect raw material price changes and consequently contracts provide the useful function of fixing their raw material prices. The producers, whose returns from potatoes are often subject to great variability, are frequently keen to participate in contracts as long as they will give them an adequate return which compares favourably with that from other alternative enterprises.

Those who are buying from the Netherlands rely upon wholesalers or co-operatives to supply suitable potatoes on the basis of contracts. The reason for this is the central role which wholesalers and co-operatives play in the Dutch potato marketing system by sorting the crop into different size fractions according to its destination. The large potatoes (50-55 mm plus) go for french fry manufacture either in the Netherlands or in other countries and the 35-50 mm size for the domestic and export ware markets and the crisp industry. In such circumstances the generation of a separate

supply channel would be expensive and unnecessary. The wholesalers and co-operatives in turn arrange their supplies with farmers through contractual arrangements. A good deal of responsibility for the storage is placed in the hands of wholesalers and co-operatives, and whilst they may not always do the storage themselves they will exert control over the storage practices of those who store on their behalf. If the processor finds that the wholesaler or co-operative is unable to supply the quality of potatoes which he requires then he has the ultimate sanction of rejection.

The crisp manufacturers who are not drawing on potatoes from Dutch co-operatives and wholesalers have a choice of suppliers from among wholesalers, various forms of producers' organisations and individual farmers. The manufacturers could also grow potatoes themselves, although vertical integration back to the production of potatoes is only carried out by a French co-operative and an Irish company. Most crisp manufacturers would consider that producing their own potatoes is an unnecessary extra headache and would prefer to concentrate their skills on the specific tasks of manufacture and distribution. The only situation in which growing might be considered is if there is no other way of guaranteeing the supply of the appropriate quality raw material - this is the reason why the Irish company has involved itself in the risks of production. The precise method of procurement adopted varies according to the manufacturers' circumstances. Wholesalers, if used, will, in turn, need to establish their own contractual arrangements with producers to ensure that the continuity of supply and necessary quality is secured. Wholesalers play a very important part in supplying some crisp manufacturers who are not drawing supplies from the Netherlands. This is particularly true in the large United Kingdom industry where merchants play an important role in organising the supply of potatoes to the factories. They are engaged because it enables the manufacturer to concentrate upon what goes on in the factory and in the selling of the crisps and leave all the problems of procurement (including delivery) to a merchant. However, some manufacturers have felt the need to get more involved in procurement (mainly to ensure that quality is maintained) and have established direct contracts with growers or growers' organisations (although there is no reason why close links cannot be maintained with growers even when buying through merchants). A large part of the United Kingdom manufacturers' requirements is met through contracts direct with growers and this is the exclusive method of purchase for crisp manufacturers in France, Ireland and Denmark.

Crisp manufacturers also purchase through a wide range of producers' organisations. These organisations take a variety of different forms and range from formalised co-operatives to rather more informally organised groups of farmers, some of which do no more than conduct negotiations with processors. The nomenclature used in referring to producers' organisations is often confusing and this applies particularly to the title 'producer groups'. Farmers who have combined to carry out a number of different functions are common in most countries of Europe but whilst they might be referred to as producer groups there are important differences in definition and in emphasis between the different countries. In this report the term producer group refers to all organisations which carry out some joint function in relation to the sale or negotiation of the members' potatoes but excludes any organisations with the possibility of buying potatoes as well as selling them such as permitted with most co-operatives. Producer groups may take on a range of functions but most commonly in the potato sector they are formed to act on behalf of individual growers in the sale

of their potato crops. Such groups have been encouraged in France and West Germany by government policies and they represent an alternative to direct contracts with growers.

From the manufacturer's point of view there are advantages and disadvantages associated with dealing with farmers organised as a group. Buying through producer groups is particularly advantageous where agricultural structures are poor and the processor is purchasing from a large number of individual producers (e.g. in certain parts of West Germany). In these circumstances the existence of a producer group can help reduce the administrative costs of the processor and improve communications with the grower (and hence the ability to influence his production and handling methods).

However, where the production structure is better (e.g. in the United Kingdom), the crisp manufacturer can procure his requirements from a relatively small number of producers and easily maintain a regular close relationship with them without forming a producer group. Naturally in this situation there would be greater uniformity in the raw material than if there were a large number of suppliers. Although, even in these circumstances, producers may group together for certain purposes such as negotiation of contracts or simply as a means of informally improving the communications between the processor and grower. Which precise form of procurement is adopted depends very much on the particular circumstances of the processor.

There is only one European crisp manufacturer which is organised as a co-operative, and this organisation relies almost entirely upon its members for supply of raw material.

As good storage practice is so critical to the quality of the raw material for crisping there is every incentive for the manufacturers to maintain a strong element of control over this. Indeed in several countries manufacturers are commonly storing a large percentage of their supplies at the factory. In fact, in some countries or parts of countries, because of the absence of a well developed potato marketing system, the manufacturers may have no choice but to shoulder the responsibility for storage themselves. In these circumstances, if supplies are to be drawn from stores away from the factory this is usually done earlier in the season when the effect of storage practices is less critical. However, potato storage is extremely expensive and consequently in those countries where adequate on-farm storage is available there has been every incentive to use it. On the other hand, even in these countries this is a difficult area to generalise about as policies with respect to storage differ quite markedly from firm to firm. Some companies have been content to leave a fair bit of responsibility in the hands of producers whereas others have considered this too risky and hence invested in their own storage.

To summarise, bearing in mind the limitation of generalisations, it appears that the main factors affecting the choice of procurement methods adopted by crisp manufacturers are location, legal form of incorporation and general business philosophy. Undoubtedly location plays an important part for whereas it might be possible in, say, the Netherlands, to consider leaving responsibility for the quality of raw material to trade channels, that would be inconceivable in some other countries because the experience or facilities of the trade (private and co-operative) and producers would be inadequate. However the procurement method adopted may

also be to a large extent determined by the legal status of the organisation, as for instance in the case of a co-operative, which will rely to a large extent upon its own members for supplies. Also the overall business philosophy and objectives of the organisation might be important: some may wish to play a large part in the growing and storing activities, and consequently play an advisory and often supervisory role during growing and take full responsibility for storage; others, in parts of Europe where it is practical, might see their range of activities covering only the processing and marketing of crisps, and hence lay the responsibility on others to grow, store and supply their raw material.

The annual quantity of raw material required by the crisp manufacturers is usually much more easy to predict than it is in some of the other potato processing sectors as the volume of sales of crisps is largely independent of prices of fresh potatoes. In this respect raw material procurement presents fewer problems than other forms of potato processing.

When purchases are made on the basis of pre-season contracts the contract price tends to be determined on the basis of an assessment of production costs plus an appropriate level of profit for the farmer. In considering what level of profit is appropriate, the producer takes into account the possible return from other crops and in particular the risks involved in growing potatoes for the ware market. The processor is naturally anxious to pay a price which will be sufficient reward for the producer in comparison with the possible profit from other enterprises, but he also needs to bear in mind the development of the market for the product. Processors vary quite considerably in their attitude to contracts and contract prices. Some might set a straight price per tonne, others might include some formula which pays the growers a return which is more closely related to the size of the harvest. Those processors who are buying potatoes which are traded on the ware market from wholesalers or co-operatives are likely to find their contract prices are much more directly affected by the present or expected future ware market situation.

Because the quality of the raw material is so important to the crisp manufacturer there will often be specific quality clauses in the contracts. However this is not always the case and some organisations are content simply to specify that the potatoes should be suitable for crisping. Contracts often specify limits for dry matter content, sugar levels and levels of damage and disease, although these may vary from season to season, depending on the general effect of climatic factors.

Almost all contracts will lay down maximum levels of tolerance for damage and disease of the delivered potatoes. Sometimes this will be a straight accept or reject level, but more commonly a system is used which penalises farmers according to the different number or seriousness of faults up to a maximum rejection level. Some manufacturers incorporate into this system separate tolerances for the different kinds of defects in order to discriminate against those which are particularly troublesome. Dry matter content (or starch content) is often specified in contracts and in order to encourage production of high dry matter content tubers, some companies may pay premiums for higher levels or deduct penalties for low levels. It is unusual for contracts to specify premiums for different levels of sugar, mainly because, as we have seen previously, there is less concrete evidence to suggest that the farmer can influence sugar levels through his cultural practices. Indeed some processors dispense with paying incentives for higher levels of dry matter content on the basis that certain uncontrollable environmental factors could be just as important as the efforts of farmers.

The raw material is invariably checked by sample on arrival at the factory and some fairly elaborate assessment procedures have been adopted because of the sensitive nature of the operation. There are examples of independent quality assessors being hired, assessors having to swear on the Bible, and farmers being given the right of being present at the assessment. In addition there may be an appeal and arbitration procedure should the producer disagree with the assessment.

The assessment of the sample involves testing dry matter content by measuring specific gravity, and also the reducing sugar level by chemical analysis or test frying. The percentage of defects in the delivery will also be assessed to see whether or not it meets the contract requirements. With the possible exception of the reducing sugar test most of these assessments are relatively easy to carry out. The lack of a reliable measure for reducing sugar levels (and just as important the imperfect correlation of the results of some tests to crisp colour) is a major problem for the industry and often the cause of friction between manufacturer and supplier.

When manufacturers are buying from wholesalers or co-operatives on mainland Europe it is quite common for them to use the RUCIP rules governing intra-European trade in potatoes.[1] These rules outline various standard practices for use in contractual transactions between buyers and sellers of potatoes and include procedures for settling disputes between parties.

The pattern for negotiation of prices varies from country to country and organisation to organisation. Where direct contracting with farmers is being undertaken negotiations of contract begin as early as possible, often in November or December. This gives farmers plenty of time to adjust their farm plans should it be necessary and it also gives the manufacturers an adequate period to plan the next processing season. Negotiations in the Netherlands seem to take place a little later than this. This may just be a tradition or it may result from farmers and wholesalers waiting for the first futures contract quotation for the next season before committing themselves.

Contracts are in most cases negotiated with individual suppliers (they may be grower, producer group, co-operative or wholesaler); although there are a number of instances of negotiations taking place with nominated growers' negotiating committees. In some countries there have been attempts to introduce national negotiations on contract conditions or prices. The biggest efforts have been made in France, through the organisation GNIPTIT, although there have been attempts to introduce national negotiations in some of the processing sectors of the United Kingdom. Two major British crisp companies now have national growers' committee negotiations. There have also been attempts to introduce model contracts within the Netherlands, although this only applies to produce for french fries. However, nowhere in Europe can be found the very highly developed negotiation procedure found in the United States, where potato producers have formed large groups to increase their bargaining power and to fund fully researched contract negotiations.

---

1 laid down by a European committee comprising delegates from the main European representative organisations of potato wholesalers and potato processors.

The manufacturing process

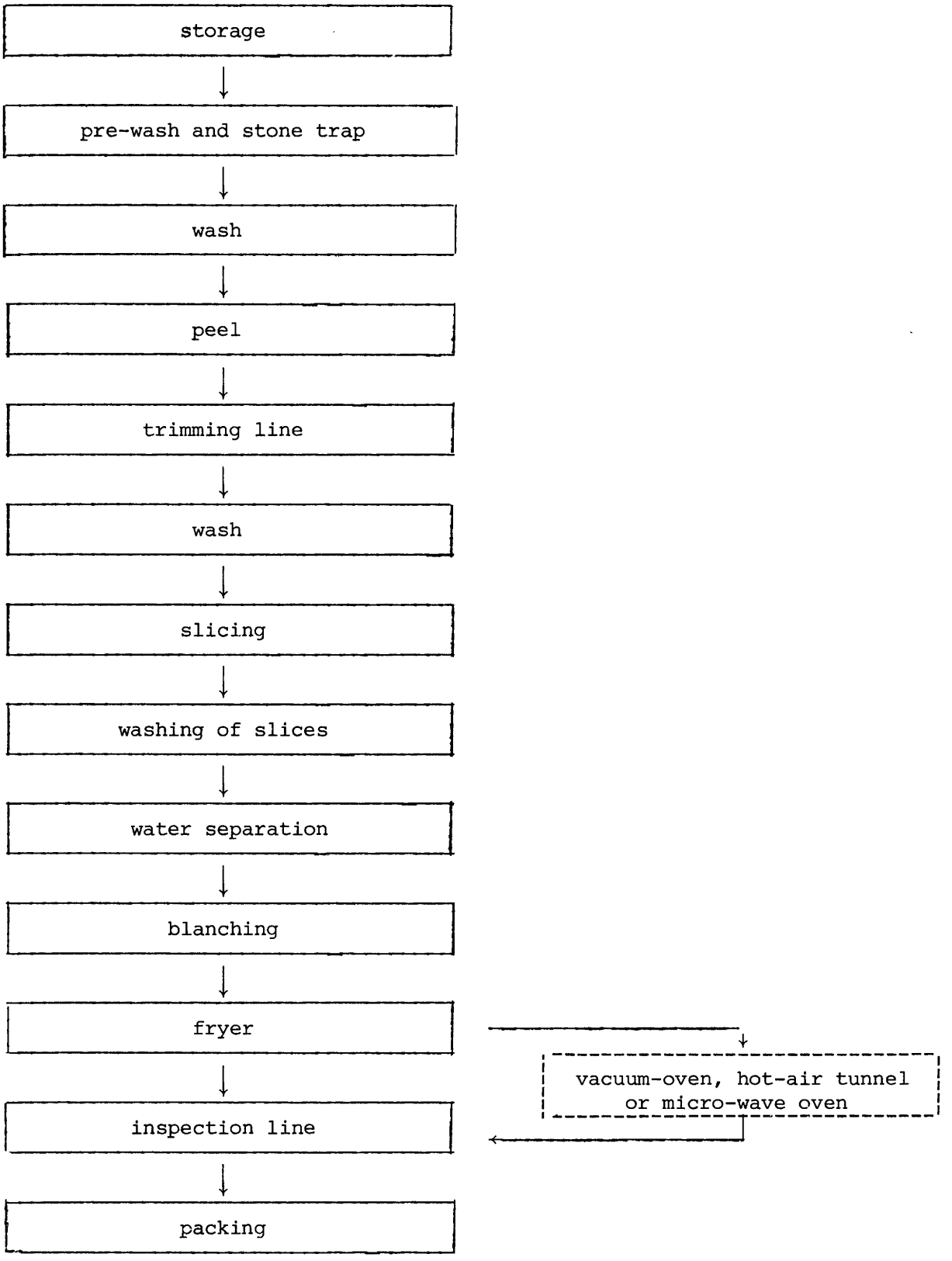
The different elements in the crisp manufacturing process are indicated in the following diagram. Because reducing sugar content is so important to the overall quality of the final product, and sugar levels are influenced by storage regimes, an account of the crisp manufacturing process should begin with acknowledgement of the importance of control over storage conditions. It has been noted that many processors take on the responsibility of storage because of its importance and it is quite common for storage to be located at the factory or in a manufacturer supervised store. The potatoes will be tested for sugar content when they go into the store and regularly through the storage season. Temperature and humidity will be closely regulated to ensure that sugar levels are kept down and dry matter content maintained.

Potatoes move from storage through a pre-washing procedure where the potatoes are roughly washed and any stones collected in a stone trap. After this the potatoes are given a thorough wash to fully expose the skin of the tuber. The consumption of large quantities of water is an issue of concern to all potato producers and significant efforts have been made to reduce the quantity consumed. Most methods of reducing water consumption involve re-circulating the water used and very simple measures can reduce consumption quite significantly.

The potatoes then move onto the peeler which in most cases operates on a continuous production line basis. There are various alternatives but normally for crisp manufacturers abrasion methods of peeling are utilised. In the manufacture of crisps it is not necessary to remove all of the skin, for the potato is being sliced into very thin slices and the adherence of small quantities of skin on the tuber has very little effect on the overall appearance of the crisp. Also abrasion peelers do not apply heat to the tuber and consequently the problem of 'heat ring' is avoided. This is the formation of an outer ring of heat-affected cells which tend to discolour at a different rate to the uncooked centre of the tuber in the cooking process and thus cause a characteristic 'heat ring' on the fried crisp. Nevertheless, there are some factories which utilise caustic lye (sodium hydroxide) peeling method which combines the effect of chemical attack on the peel with heat and mechanical abrasion. Following the peeling process, the potatoes are washed again to remove any pieces of peel which adhere to the surface and are then passed along an inspection line where tubers which are unacceptable for processing are rejected and those with minor blemishes are trimmed so that all defective parts of the tuber are removed. This part of the manufacturing process is labour intensive, although the number of persons employed at this stage of the process depends entirely on the quality of the raw material being used. At this stage large potatoes may also be halved in order to reduce the vulnerability of the fried crisps to breakage and to eliminate problems of filling packs at the end of the production line. Peeling losses can be quite significant if the shape or form of the potato is irregular. Estimates of peeling losses vary but even with abrasion peeling the peeling and trimming process could account for something like 15% of total fresh weight. These losses can increase production costs quite considerably and consequently it is an important stage over which control is needed.

Should there be any delay between the peeling stage and the frying stage there is always the possibility that some enzymic oxidation will occur. On most continuous crisp manufacturing lines the delay is often so short that oxidation cannot begin. In any case the problem can be easily overcome by holding potatoes in water or a weak solution of sulphur dioxide.

Manufacture of crisps



The next stage is the slicing of potatoes and a range of different types of machines is used to carry out this function. As the cells along the slice are destroyed there is another loss in weight at this stage. During slicing starch is released from each of the damaged cells along the cutting surface and this has to be removed by another washing stage in order to prevent the slices from sticking together during the frying stage. Estimates of the weight losses as a result of slicing vary but seem to lie between 1 and 2 per cent of the raw potato. Because of the release of starch the water which has been used for the washing of slices is high in starch content and the disposal of this effluent represents a very major problem for crisp manufacturers. Indeed the general problem of effluent disposal represents a high cost for most forms of potato manufacture. The effluent of potato processing factories can be a nuisance and has a fairly high biochemical oxygen demand (BOD). The BOD is a measure of the oxygen necessary to assist the biological decomposition of the organic waste and it is a means of measuring the pollution strength of the waste. When effluent is discharged into water courses the oxygen necessary to decompose the organic waste is taken from the river and as the available oxygen is limited, other living plants and animals are deprived of their essential oxygen. Treatment of such waste can be overcome to a certain degree by screening out the solids and allowing smaller sized solids to settle in settling ponds. Often this is not enough and further treatment may be necessary to encourage the biological decomposition of the organic matter which remains often in a dissolved form. There has been increasing pressure upon potato processors to improve the quality of the water which they discharge into public waterways or effluent disposal systems although there are substantial differences in costs and constraints both within and between countries. In most, but not all, countries, potato processing firms would expect to have to invest in treatment plants which would encourage decomposition of most of the potato waste, although local circumstances may make such investment more or less essential. In some cases government aids for such facilities have been available in the past.

After the washing of the slices some companies blanch the crisps in hot water. This is one of the techniques which can be used to control the levels of sugar in the potato (and hence colour in the crisp) and which was referred to in the previous section. Some organisations prefer not to blanch because they consider it reduces the flavour of the crisp. Others suggest that the texture is altered.

Before frying, the potato slices are usually partially dried to shorten the frying time and save the cost of energy used in heating the frying oil. A number of methods are used which may include a vibrating sieve or blowing warm air over the slices.

All the major crisp manufacturing factories utilise continuous frying techniques. The fryers are rectangular flat-bottomed oil containers through which the slices of potato are passed. The oil in which the crisps are fried is continually circulated and filtered to remove any small pieces of fried potatoes. Also it is continually being topped up as the crisps absorb oil during the frying process. Heat is applied, usually by means of a heat exchanger which can be actually underneath the fryer or else be located elsewhere with the hot oil being pumped into the fryer. The fryer will be equipped with a mechanism to adjust the speed at which the crisps are transported through the oil to control frying time. The temperature of the oil can also be varied. The water vapour which is released from the process escapes via steam vents into the atmosphere. Within the steam can be small

droplets of oil and these can discharge a typical frying odour into the atmosphere. This can cause a nuisance in built-up areas although fairly simple modification of flue design has reduced the problem.

During the frying stage there are several factors which are absolutely critical to the success of the crisp manufacturing process. In particular the crisp manufacturer has to be well aware that the heating of oils causes a number of changes in their physical properties. In particular, oils undergo some oxidative reactions at higher temperatures. This is a slightly different reaction to the normal slow oxidation of oils at room temperature (autoxidation). When oil is heated, oxygen from the air is combined with it, and rancid flavours can result. In addition to oxidation there are two other decomposing processes which occur when fats are heated at higher temperatures. These are hydrolysis and polymerisation which occur when fats are heated at high temperatures for a very long period of time. The former is a relatively minor problem and the latter is of less importance to the crisp manufacturer than oxidation.

The manufacturer overcomes the problems of the instability of the oils used in frying by good 'oil housekeeping', the inclusion of antioxidants in the oil and the use of specially prepared oils which do not develop oxidative rancidity very easily. Under the heading of good 'oil housekeeping' one might include the correct handling of the oil, the avoidance of excessive heat, a rapid rate of replacement of oil, suitable filtering, the avoidance of aeration of the oil during circulation, and the avoidance of any kind of contamination. The adding of antioxidants such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) can reduce the problems of rancidity in crisps by providing some measure of protection from the oxidation process. These two chemicals have been used for a number of years in the potato crisp industry although the level of incorporation is closely controlled in all countries.

There is a wide range of different oils or fats which the processors could use for frying. In particular groundnut and cotton seed oil are popular although there are many blends available, some of which have been prepared especially for the frying of potato products. Most of the oils which are used have been subject to hydrogenation, a process which results in increased stability of the oil to oxidative rancidity. Hydrogenated oils are treated with hydrogen gas at a suitable temperature and pressure in the presence of a catalyst in order to combine hydrogen to points of unsaturation in the fatty acids.

The frying stage can be completed by the use of vacuum fryers, tunnel dryers or microwave ovens as was indicated in the previous section on the methods of controlling the colour of potato crisps. Vacuum fryers are used in a number of European factories with some success although some companies have tried them and found difficulty in applying them to their particular circumstances. They tend to be used selectively during periods when reducing sugars are high such as at the end of the storage season. Most microwave ovens have been replaced, largely because of their high energy consumption.

The oil content of the crisps is a particularly important consideration for the crisp manufacturer. Oil is an expensive product representing an extremely important cost for the manufacturer. If it is absorbed into the crisp in large quantities not only is the cost of the process increased, but

also the quality of the final product is reduced. A high oil content not only makes the product appear greasy but it increases the calorific value of the potato crisp. We have already seen that potatoes with a high dry matter content have a much lower rate of oil absorption. It is also understood that oil content is reduced by partial drying prior to frying, blanching, the use of certain types of oil, the temperature of the oil and the length of the frying period.

After frying, and following inspection, the crisps are salted and/or flavoured and then they are packaged. In the packaging section of the line the crisps are weighed, placed into packets, sealed and packed into cardboard outers. Whilst the packaging process is automatic this section of the factory still requires a large amount of labour for the filling of the outers. The labour involved in this part of the process is often additionally carrying out a quality control function for they can check poor sealing of the packages and bad presentation. The design of appropriate automatic packaging machines has advanced quite considerably and rarely causes any real problems for crisp manufacturers, although, because they are such sensitive machines, they require quite frequent attention and adjustment. Often quite a large number of packing machines are required in order to be able to cope with the output of some of the modern fryers. With a product like crisps which are sold in low weight packages the filling of packs is an important operation for the inclusion of one large crisp in a 25 gram packet could significantly increase the actual weight over the prescribed minimum. Large crisps are therefore avoided for small packs. Accurate weight measurement at this stage is also vital as there is so much to be lost by over-filling.

In most countries today there are legally prescribed labelling requirements and these have been noted by a number of manufacturers as causing some difficulties. Ingredients usually have to be specified and some countries insist upon date stamping. Also in some countries there are voluntary declarations of the nutritional content of the product.

After the packing process the difficult and expensive distribution function can begin. The expected shelf life of potato crisps can vary quite considerably, depending upon environmental factors, although most products have an ideal shelf life of around eight weeks given correct storage.

Marketing considerations

There are a number of interesting features of the market for potato crisps. To begin with, as has been noted previously, the market is dominated in each of the Member States by a very small number of manufacturers each with their own brands. Consequently competition is tough and levels of advertising and sales promotion expenditure to support brand loyalty run at high levels. The marketing problems of the manufacturers vary quite considerably from country to country because the markets themselves differ quite considerably. In the United Kingdom and Ireland the potato crisp is a well accepted snack and consumption levels are much higher than in other European countries; although even in these two countries consumption is much lower than in the United States. The consumption of potato crisps in the rest of Europe seems to take place in a much more limited number of eating situations. For example, in West Germany, despite the efforts of the manufacturers, crisps are rarely eaten as snacks, and their consumption is reserved for certain social eating situations, such as at parties, with an aperitif, or whilst watching television. Consequently

crisps are rarely sold in small (25 gram) packs. The consumption of crisps in drinking houses, which is characteristic of the United Kingdom and Ireland, has not developed elsewhere. Children seem to be important consumers throughout Europe, although again there are major differences between countries. In recognition of this, advertising and sales promotion is aimed directly at children and can include small toys in the packets, competitions, collecting series and comic strips.

Each of the Member States differs quite considerably in the development of the market for flavoured crisps. In the United Kingdom flavours are very important and account for 60 per cent of the market. There is a wide range of flavours available and new ones appear on a regular basis, although the plain salted crisps still maintain a faithful following. In Ireland plain crisps are relatively unimportant and the market is dominated by the cheese and onion flavour which accounts for four-fifths of all sales. On the EEC mainland plain salted crisps are most important and the range of flavourings is more restricted with paprika being by far the most accepted by consumers.

More recently the biggest change in the market came with the development of a number of other snack products which compete directly with crisps. However, these snack products, often made from dehydrated potato granules or flakes, are seen as an extension of the crisp market rather than competitors because the major manufacturers are the large crisp firms. Consequently the North American marketing battle between the 'natural' crisp manufacturers and the 'synthetic' snack firms[1] is unlikely to take place within Europe unless any future pattern of ownership should separate the interests of the two kinds of snack products. The development of the market for snacks other than potato crisps has been uneven and whilst mainland Europe has seen the development of a number of new specialist products (such as regular shaped prefabricated crisps) and the continued growth of some established extruded products (e.g. Nibbits in the Netherlands) the bulk of the growth is believed to have taken place in the United Kingdom.

The nutritional contribution of crisps has become a more prominent issue in the product's marketing environment in recent years and it seems likely to gain in prominence in the future, especially if trends in the United States are to be followed.[2]

Because of the very high cost of transporting crisps the volume of international trade is modest. Small quantities are exported from the United Kingdom (to Ireland) and Irish and French supplies are imported. There is quite a large volume of crisps imported into Belgium from the

---

1 The North American conflict was essentially caused by the manufacturers of fabricated crisps coming from outside the potato industry (e.g. Proctor and Gamble). See for example: 'Superior wins with the real thing', Potato Chipper, April, 1974, pp.24-28.

2 In the United States there have been occasional hostile attacks on the potato crisp. For example, an editorial in the St. Louis Post Dispatch claimed crisps 'have no redeeming nutritional value' and added that the Potato Chip Industry's attempts to polish the image of crisps was 'like trying to portray Attila the Hun as a pioneer in urban renewal' (Wall Street Journal, 19th October, 1978, p.1).

Netherlands and from France and in addition the one major Belgian firm exports to the Netherlands. West German manufacturers account for the vast bulk of the supplies on the West German market although significant quantities are imported from the Netherlands and from France. Denmark exports very small quantities and Italy imports small quantities from West Germany. Imports from and exports to third countries are insignificant.

Most manufacturers choose to distribute their products directly to retailers and other outlets. Though direct selling is expensive, it provides the opportunity for more contact with customers than using conventional trade channels and facilitates regular checks on stock rotation for a product with a relatively limited shelf life. In certain countries, particularly the United Kingdom, a small proportion (10 per cent of value in 1977 in the UK) of crisps are sold under retailers' private labels.

Crisp manufacturers tend to make infrequent price changes. This is largely because of the relatively low value of individual packets and partly because of the desire of some manufacturers to maintain a stable-priced branded product.

THE MANUFACTURER OF DEHYDRATED POTATO PRODUCTS

(a) GRANULES AND FLAKES

As in the previous sub-section the dehydration business will be considered in broad terms from the point of view of raw material procurement, the manufacturing process, and the market. For the manufacture of dehydrated potato products, by far the largest single item of cost is the raw material and consequently there is much emphasis within the business on the problems of procuring potatoes. The basic manufacturing process for production of both granules and flakes was established at quite an early stage although some dehydration organisations maintain a tight cloak of secrecy around their production process in order to preserve any advantages they might have through the adoption of new techniques. At the present time marketing considerations are dominated by the spectre of competition from North American manufacturers, although Eastern European competition also raises some long-term fears.

As in the crisp market sector, there are a number of large organisations who dominate the industry although lower unit transport costs mean that many of these organisations can be considered to be producing for a wider European, rather than national, market. The principal manufacturers are Pfanni, Nähr Engel and Maizena in West Germany; Nestlé and Preservenbedrijf in the Netherlands; Dornay Foods and Cadbury-Typhoo in the United Kingdom; Van den Broeke in Belgium; Vico, Flodor, SITPA (Nestlé), SPM and SCA Beau Marais in France; and a co-operative set up by the Agricultural Development Board for the Abruzzo region in Italy.

Raw material procurement

Up until fairly recently it would have been quite easy to have generalised about the raw material requirements of the manufacturers of dehydrated potatoes. However, recent events have meant that such generalisations are now difficult to make because of the procurement policies adopted to face up to North American competition. Ideally a manufacturer of dehydrated potato products wants a potato which has a very high dry matter content (24-25 per cent, although they often have to settle

for much less than this) so that the yield of product is as high as possible. As the raw weight of the potato is reduced by as much as six or seven times during the dehydration process the dry matter content can have quite a considerable effect on the total yield. The reducing sugar level must be low to avoid scorching during processing and browning in store. Also with the increasing use of dehydrated products in the manufacture of potato based snacks, low sugars are important in order to avoid discoloration during frying. A reducing sugar level of about 0.25 per cent is the usual requirement, although in some cases higher levels (up to 0.5 per cent) can be tolerated. There are normally low tolerances for damaged and defective tubers as these add to the manufacturing costs. Tuber size is less critical although peeling losses are greater with small tubers. Potatoes with low susceptibility to enzymic oxidation and after-cooking discoloration are preferred.

In the United Kingdom the two major potato dehydration companies seem to have moved away from purchasing high quality, high specification potatoes which ideally meet the requirements of the processor, towards material which is far less ideal but which can be obtained at a much lower price. The extra cost involved during the processing, and the lower yield of final product can be outweighed by the benefit of the lower cost of raw material. However these companies emphasise that it is wrong to consider the raw material which they purchase as being of lower quality. It may be lower quality in terms of the ware market or even some other processing utilisations but as far as they and the capabilities of their factories are concerned it is just a different specification. So far, other European manufacturers have maintained their commitment to higher specification raw material although as indicated earlier those operating integrated plants have other means of reducing the costs of production.

It is a little difficult to generalise about the varieties which are used by the manufacturers of potato granules and flakes because so much appears to depend on the individual circumstances of the manufacturer. However, a number of broad generalisations can be made about varieties and procurement in those countries with dehydration industries. (There is no dehydration industry in Denmark or Ireland although in both countries companies have been making products until fairly recently).

In the Bintje producing areas of the EEC this variety is almost exclusively used for dehydration. As explained earlier, it is a multi-purpose variety suitable for the manufacture of all kinds of potato products and also suitable for ware markets throughout Europe. Because of this, in these areas Bintje is usually available at lower prices than other varieties. In fact, Bintje is generally considered to be a very suitable variety for the manufacture of granules and flakes without being excellent.

In West Germany the factory located to the west of the country also uses Bintje from the Netherlands for most of its products (as it is well within the range of the Dutch potato traders). The other West German manufacturers use a fairly wide range of varieties bought from either co-operatives, wholesalers or producer groups (mainly those which are established under the wing of co-operatives). The varieties include, for example, Juliver, Saturna, Erntestolz, Mentor, Irmgard and Maritta. Most of these varieties have only limited use in other markets.

The choice of variety in the United Kingdom has been affected by the change in procurement policy which was mentioned at the beginning of this

section. Traditionally the major companies in the United Kingdom have procured their potatoes on the basis of contracts with producers, co-operatives or merchants. Today the raw material is obtained from that part of the crop which is not suitable for the ware market, not suitable for premium ware outlets or is not required by other processors. Such potatoes are normally obtained from wholesaler or co-operative channels although some potatoes might still need to be contracted directly with growers to ensure continuity of supply. Therefore the varieties used are those which are freely available on the ware market such as Pentland Crown, or Maris Piper, or the Records not required by the crisp industry. Whereas many of the mainland European manufacturers of granules and flakes are still attempting to influence quality by issuing advice to growers on cultivation practices (often through their supplying wholesalers, co-operatives or producer groups) the method of procurement adopted by the British firms precludes this and leaves the determination of final product quality to processes within the factory gate. Such is the impact of North American competition.

The dehydrating company has available the same alternative procurement methods as the crisp manufacturer: he can purchase potatoes off the ware market at open market prices, he can buy on pre-season contracts (with growers, producer groups, co-operatives or wholesalers), or he can grow the potatoes himself. (There is another alternative, participation in production through a joint venture; this option has been chosen by one organisation and will be discussed later).

Three organisations which manufacture dehydrated products grow their own material on an important scale. Two of these are co-operatives and one, the operator of an integrated plant in Belgium, has taken this option because he has found it difficult to persuade growers to deliver on the basis of pre-season contracts. Most dehydrators have ruled out growing their own raw material because it would take them into an entirely new area of activity and they would need to farm on a significant scale in order to produce the very large quantities of potatoes which would be required. This would involve them in very high costs and risks.

The most practical alternative to growing the raw material themselves is to contract for supplies, and it is by this means that the majority of European dehydrators obtain their raw material. Perhaps the most important reason for contracting is to ensure that raw material is available for the factory in order to keep expensive capital and labour fully employed. Contracting also ensures that the right varieties are grown where these are not freely available on the ware market, and it provides the opportunity of exercising some control over quality. However, compared to the crisp sector, the need to ensure that quality is good is less critical, although this can be an important factor where manufacturers still require a high specification raw material. In addition contracting enables manufacturers to cover their own contractual commitments in product sales, and it helps them to budget ahead. This is particularly important in a sector where raw material prices are extremely variable, and where uncovered contractual sales could expose the manufacturer to high levels of risk.

However, manufacturers also have to allow themselves some flexibility by buying a proportion of their supplies from the free market in order to take account of variation in demand from year to year. This is a very real problem because demand in some parts of the market is closely related to fresh potato prices. In most parts of Europe, suitable potatoes for these

free market purchases are readily available because suitable varieties are also being used in the ware trade.

As indicated above, the problems of the British manufacturers resulting from North American competition have meant that their procurement system has been changed dramatically. However, contracts still play an important part in their procurement system (although more important for one company than the other) to ensure that potatoes of the required quality are available throughout the year. But North American competition has caused difficulties in other countries as well and in particular among those companies buying a large proportion of their potatoes on contract. In this situation, the only alternative has been for the contracted potatoes to be traded and not processed. In fact, in one particular example this has worked out well because another dehydration organisation has been willing to adapt its usual procurement system to purchase these potatoes.

A wide range of different procurement channels are used. There are examples of dehydrating organisations buying from growers, producer groups and merchants with the choice of channel depending on the individual circumstances of the processor. The relative merits of different procurement systems have already been considered in the previous sub-section on the crisp sector. Dealing with producers has the advantage that quality can be directly influenced with the disadvantage that administration of a direct procurement system is expensive, especially where large quantities of potatoes are required and a large number of growers is used.

There is only one joint venture operating in the potato processing industry of the EEC. This organisation produces dehydrated products in France and it represents an interesting combination of manufacturing and marketing skills and expertise (provided by a private company), and raw material production (provided by some potato co-operatives). The advantages are in terms of specialisation of expertise which has to be weighed against the possible disadvantage of greater inflexibility in raw material procurement activities.

It is common (though not universal) for the price paid to the raw material supplier to be related to the dry matter content, for this is one of the most important qualities as far as the manufacturers are concerned. However, this does not apply to the British dehydrators whose method of raw material procurement has already been discussed. The contract conditions concerning damaged and diseased potatoes in mainland Europe resemble those used in the crisp industry, although, as the quality requirements are slightly lower, it is more likely that the national, or even possibly RUCIP ware norms will be used. Contracts may indicate the timing of delivery of supplies, arrangements for transport and storage and a few other sundry conditions.

There is a wide range of different ways in which prices can be incorporated in contracts but perhaps the most common in the dehydration sector is the use of fixed price contracts. The acceptability of fixed price contracts to producers depends entirely on their philosophy with regard to the growing of a potato crop. Producers in some countries have regarded potatoes as a speculative crop and have welcomed the chance to play the market and consequently are not interested in fixed price contracts. Such attitudes are usually found in those potato markets which have exhibited high levels of price volatility, where the costs of tying yourself to a fixed price contract in a year when prices go very high can be

substantial. The poor discipline on the part of raw material suppliers of an Irish manufacturer of potato flakes and dehydrated potato pieces undoubtedly contributed to the failure of that enterprise. In the same way the establishment of any kind of potato processing enterprise in Belgium on the basis of fixed price contracts has been inhibited by the reluctance of farmers to take up such contracts and undoubtedly examples could be cited in other countries.

The previous sub-section concerned with the crisp sector has already discussed the procedures for receiving potatoes at the factory and the same applies in the dehydration industry although reducing sugar levels, whilst important (especially if the product is to be used in snack manufacture), are slightly less critical.

The negotiating pattern for procurement of raw material is very similar to that outlined for the crisp sector and it is unnecessary to add anything which specifically relates to the dehydration sector.

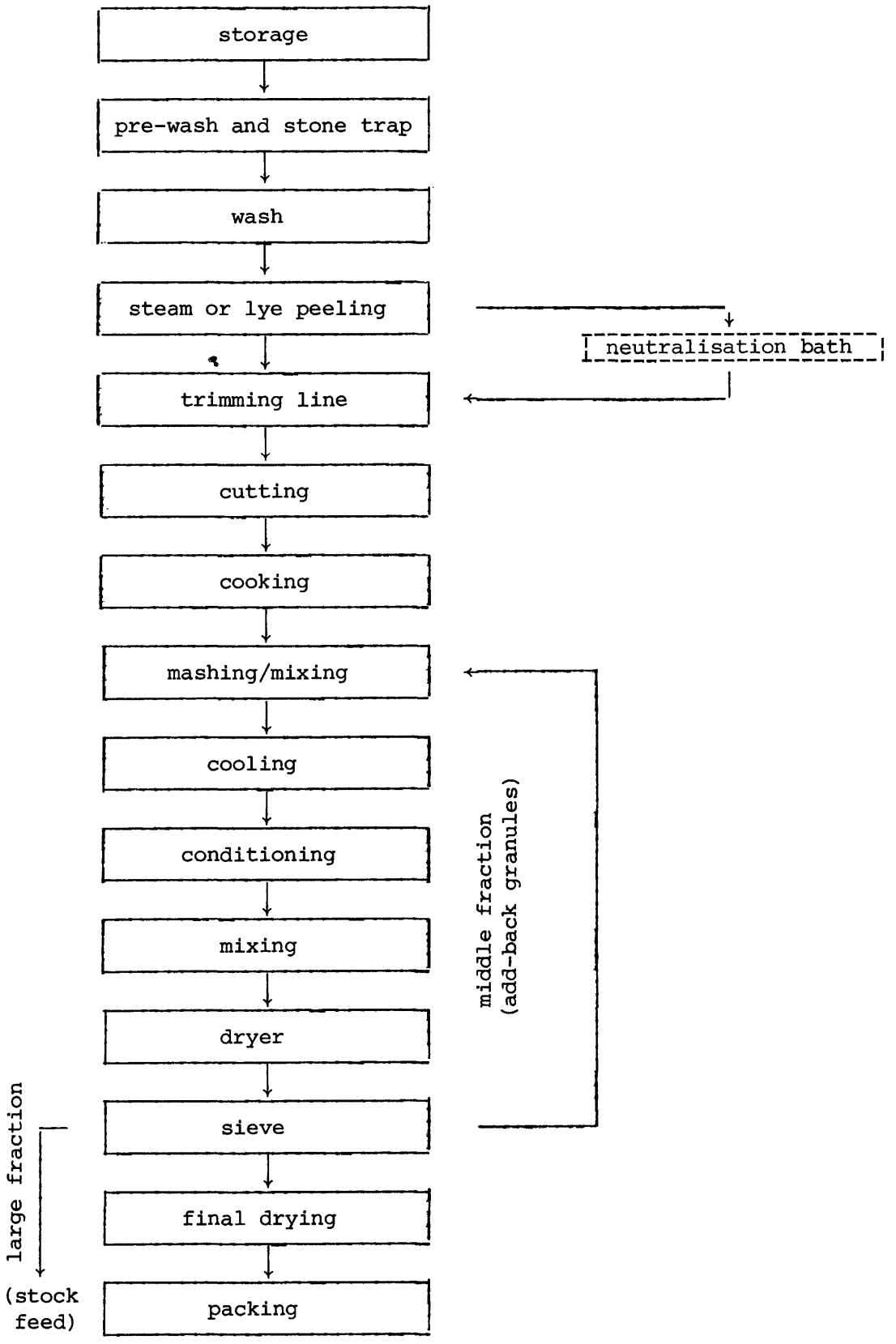
The manufacturing process

The different elements in the manufacturing process for potato flakes and potato granules are illustrated in the following diagrams, and a generalised account of the process will be given. Naturally there are some differences in the process used by the various manufacturers but they will all broadly follow the general pattern outlined. As can be seen, the preliminary pre-peeling activities are the same as those used in the crisp process. Methods of peeling tend to be different because a much higher percentage of the peel must be removed. There are two main methods which are adopted, either steam or caustic lye peeling. There is some evidence that the latter method is becoming less frequently utilised, mainly because of the problems involved in the disposing of the waste. This is particularly important where the processors are hoping to sell their peelings for animal feed. The basic lye peeling method involves dipping washed potatoes in a hot sodium hydroxide solution followed by the washing off of the skins with a high pressure water spray. Steam peeling involves subjecting the potato to high pressure steam to rapidly heat and loosen the peel. When the potatoes move from the high pressure steam peeler to atmospheric pressure the vaporisation of moisture in the heated tissue further loosens the peel. High pressure water sprays remove the softened tissues. If the potatoes are peeled by the lye method they must be thoroughly washed. The resulting effluent has a very high BOD and can be an expensive problem for processors to overcome. The remaining caustic on the surface of the potato is inactivated in a neutralisation bath containing a dilute acid solution.

After peeling, potatoes are inspected and trimmed before moving on to the next stage of the process. As for the manufacture of crisps it is important to avoid any enzymic oxidation at this stage and sulphite may be applied.

It is usual in both flake and granule manufacture for the potatoes to be cut prior to any cooking as this facilitates the even cooking of the potatoes, also if the potatoes are cut very small, it provides the opportunity of blanching the cut pieces to remove excessive sugars should it be necessary. Blanching involves subjecting the potato to heat and consequently should also be considered as an important step in the cooking process.

Manufacture of potato granules



In the manufacture of granules the potatoes are usually cooked in steam at atmospheric pressure. The next series of activities are critical. The potatoes have to be mashed without rupturing potato cells so that granulisation of the cooked potato into individual cells is achieved. As was indicated in Section I, if any cells are ruptured then starch is released and if this becomes excessive the product becomes extremely sticky and reconstitutes poorly. The granulisation is improved by reducing the moisture content during the initial mashing of the cooked potatoes and introducing into the process a conditioning period (in which the mashed potato is held for a short period at cool temperatures). The reduction of the moisture content is achieved by mashing the hot cooked potatoes in the presence of granules which have already been dried. This friction of dry and partially dry granules against cooked potato tissue results in a breakdown of the potato into individual cells with the minimum of rupture. After the mashing and mixing activity the moist mash is cooled before conditioning. After conditioning it is mixed again and then the drying period begins. The drying is normally carried out with the product airborne and this ensures the particles dry separately and avoid agglomeration. The drying is achieved by blowing hot air through the moist mix in a cyclone tower. The product dries as it rises in the tower and remains suspended until the weight of the granules is sufficiently reduced for it to be swept over the top of the air drying cylinder. The product is not fully dried at this stage as the coarser material is needed as 'add-back' for the mashing of the newly cooked potatoes. The finer material is then dried from 12-13 per cent to 3-5 per cent moisture content by passing it over a fluidised bed-dryer which dries the granules further on a bed of hot air. Careful control is necessary at all stages in the process to ensure that there is no breakdown in the potato cells.

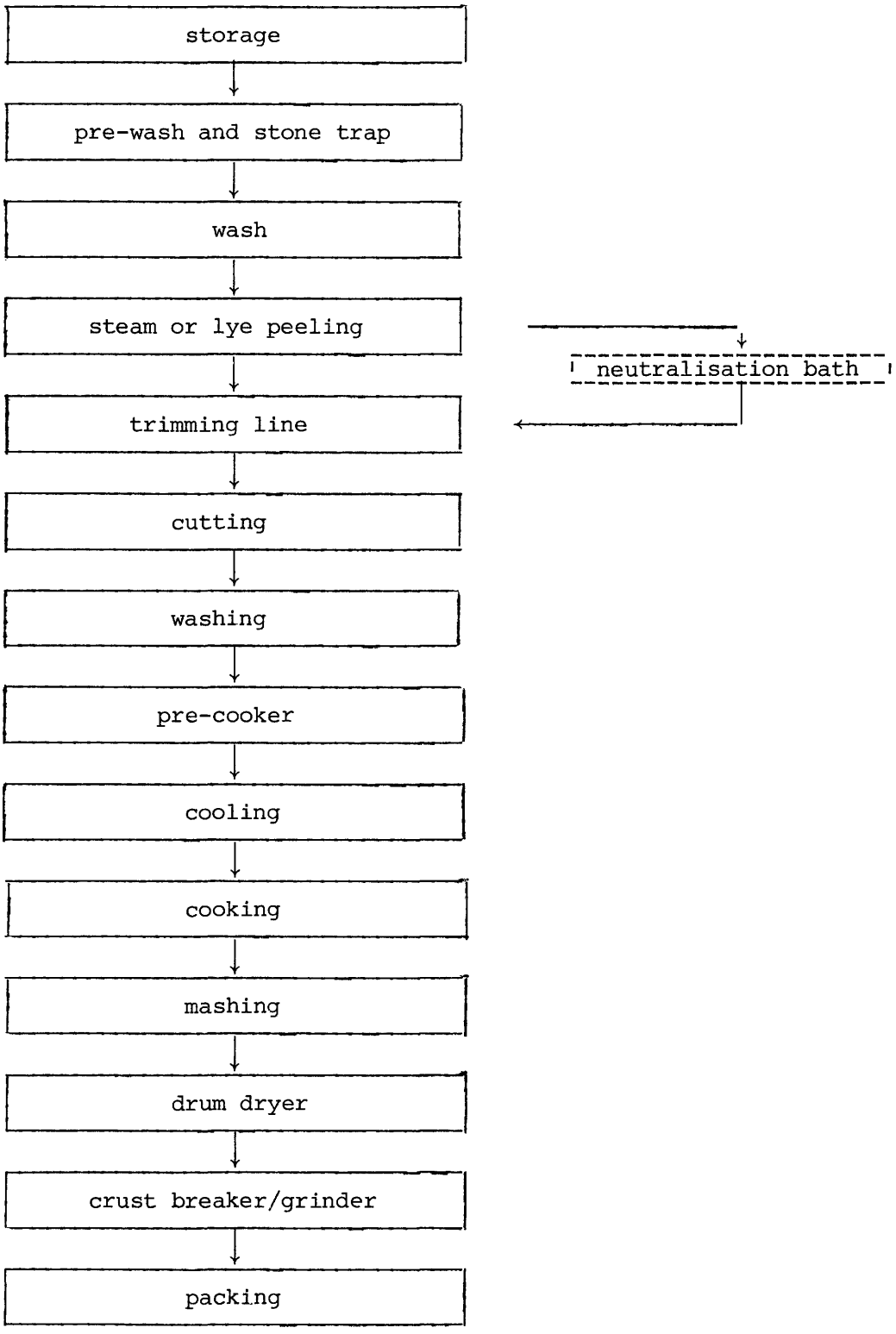
Dried material can then go for storage and it is packed out of storage as and when needed. Oxidative deterioration of dehydrated products in store can be a very serious problem. It is understood to be related to the fat content in the potato but the precise mechanisms at work are not fully understood. The problem has been partially overcome by the incorporation of antioxidants such as BHA and BHT. Alternatively the storage of dehydrated potatoes in an inert atmosphere such as nitrogen can control the rate of deterioration. Non-enzymic oxidation caused by high reducing sugar levels can also be a problem and can be reduced by sulphiting or the partial removal of sugars by blanching.

The product is also subject to some after-cooking discoloration and consequently there may be a need for the application of chemicals such as SAPP. Other additives can include emulsifiers (to improve texture on rehydration), flavourings, colour, vitamins and milk powder.

As can be seen in the diagram the manufacturing process for potato flakes follows that for granules up to the cooking stage. As in the manufacture of granules it is possible to include a blanching step which can be used to inactivate the enzymes in the cut potatoes and consequently reduces the problems of sugars causing discoloration during drying. Sulphite may also be applied to allow the use of higher temperatures during drying without causing non-enzymic discoloration and to reduce the risk of deterioration during storage.

As with the granule process, a major consideration is to avoid damage to the individual potato cells and thus retain a good texture when reconstituted. The standard method of achieving the best possible texture

Manufacture of potato flakes



for potato flakes is to pre-cook the cut potatoes in water at temperatures high enough to gelatinise the starch in the potato cells, but avoiding too high temperatures which would result in the softening of the inter-cellular bonds. The pre-cooking process is understood to change the nature of the cementing substance between the cells so that the cells can be evenly divided without causing damage. The pre-cooking process also swells the starch in the cells very gently. The pre-cooked potatoes are then cooled so that the starch can be allowed to contract and then a final cooking stage takes place. Apparently, even if cells are damaged during the final cooking and drying stages, the starch which escapes does not make the finished product quite as sticky as starch that has not been subject to this retro-grading process.

The pre-cooking stage will usually take about 20 minutes in water at 70-75°C, the cooling stage 20 minutes in water of 20°C and the final cooking stage can vary between 20 and 40 minutes. After cooking the potatoes are mashed, usually by pushing them through ricing machines, this method being found to damage the potato cells least.

Before drying, any necessary additives are incorporated into the mash. Amongst the additives which may be incorporated at this particular stage are sulphite, to retard non-enzymic discoloration, an emulsifier (usually mono- and di-glycerides of fatty acids), antioxidants, such as BHA and BHT, chelating agents such as SAPP, and citric acid. Like the crisp and granule manufacturer the flake manufacturer has to be careful that maximum legal levels of additives in the final product are not exceeded. This involves very careful calculation, for the level of additives detectable in the final product is often different from that which is incorporated.

After ricing and the addition of additives the mashed potato is dried on an internally heated drum dryer equipped with a number of applicator rollers. Mash is fed onto the top of the drum and as it turns it is held against the drum by the rollers. The clearance between the top roll and the drum surface determines the movement of mash to the rolls beneath. Each roll applies a layer of potato cells to the sheet passing beneath it so that the finished product comprises a sheet of dried potato several cells thick. The dried sheet of potato cells either breaks off the heated drum surface by itself or is detached by mechanical methods. It is then carefully broken up into flakes. In order to control the drying process the speed of rotation of the drum, the internal pressure of the drum and the clearance of the rollers can be varied. For a reason which nobody fully understands defective potato cells are collected on the bottom roller which can be easily removed. The product is then stored ready for packaging.

As well as maintaining careful control over quality the processor is anxious to reduce the level of losses. In addition to those losses in peeling, trimming and slicing (say 10-15 per cent) there are also losses associated with pre-cooking, cooling, cooking and the loss of mash from the applicator rollers. Careful control of each of these parts of the process is therefore vital to maintain yield as well as to control quality. As with the granule process constant checks on quality are required in order that regulatory actions might maintain quality levels. The storage of potato flakes requires the same kind of care as for granules. Storage in nitrogen provides a great deal of control over deterioration as does the incorporation of the additives.

Because potato flakes are dried relatively quickly in a single step they are probably more easily rehydrated than potato granules. The fact that they can be reconstituted using cold water has meant that they have certain advantages over potato granules especially for use in frozen dinners. However unlike potato granules it is not possible to rehydrate potato flakes using boiling water as the flakes rehydrate too rapidly and this results in excessive cell rupture and a bad texture. Consequently it is common to see that rehydration procedures include advice to incorporate milk which consequently ensures that rehydration does not take place at boiling point.

As with potato granules the flakes can be fortified by the addition of vitamins and minerals and it is also common to see the addition of dried milk powder and, less commonly, colouring agents.

Marketing considerations

The market is divided into institutional, retail and industrial segments. The institutional market comprises all those organisations involved in catering of one kind or another and it is usually serviced in sacks and large packs. The retail market involves the sale of small packs to consumers and the industrial market includes those organisations making snacks as well as those who are purchasing dried potato for incorporation into other dehydrated or frozen products or for use in the manufacture of snack products. In all these markets granules and flakes compete.

On the mainland EEC the retail market is largely dominated by sales of flakes although granules are available. There seems to have been a resistance to granules for a number of reasons but it has been suggested that particularly important has been the apparent value for money of flakes with their more bulky presentation, although undoubtedly other factors have played their part. In the United Kingdom, the retail market is dominated by granules (often sold in agglomerated form[1]) and it is the only product which is manufactured by the two major instant mashed potato processors in that country.

For the reasons outlined previously there may be some slight advantage in using granules for the institutional market, although flake is used in substantial quantities by caterers in many countries in Europe. Industrial consumers can use both flake and granules, although for freezing purposes flake may have advantages because it can be rehydrated using cold water. The manufacturers of extruded and other snack products can use either type of product although in Ireland and the United Kingdom granules have been most important.

The potato granule or flake is an ideal example of a convenience food. To prepare mashed potato from raw potatoes involves washing, peeling and boiling whereas instant mashed potato in the form of granules and flakes can be prepared in the time needed to boil a kettle. Purchasing mashed potato in a packet one-sixth the weight of raw potatoes also has its advantages. The product can also be stored longer and takes up much less room during

---

1 The granules are subjected to an additional stage in the process to produce small agglomerates of granule. This may involve rewetting and drying.

storage. The development of the market for such products came with the increase in consumers' incomes and their willingness to pay higher prices for products which were more convenient to use. The growth of convenience foods also increased as women went out to work more frequently leaving less time to cook the mid-day or evening meal. The advantage of convenience in the institutional kitchen has also become more important as labour has become more expensive and the need has arisen to simplify catering activities and maintain consistent levels of quality.

There have been a number of problems in the development of this market. A major difficulty has been the relationship of sales of granules and flakes to the price of fresh potatoes on the fresh market particularly in the retail market and also in some parts of the institutional market. This has often presented problems for the manufacturers in establishing the quantity of potatoes required for the market and the pricing policy. As a result producers of these products have to keep a very close eye on the developments in the ware market so that they can adjust their business operations accordingly. The industrial market is not affected by the price of fresh potatoes.

A number of companies has dropped out of the manufacture of potato granules and flakes over the years, indicating the difficulties of this sector. A contributory factor in recent years has been the availability of competitively prices products from North America and occasionally from eastern Europe. Undoubtedly this competition has had a very serious effect on the development of the entire sector. Some organisations have introduced new raw material procurement policies based mainly on processing lower grade raw material. The cheaper imported dehydrated potato is also blended with products produced from European potatoes. It is understood that a number of organisations are operating well below capacity in the wake of this competitive pressure.

There are several hypotheses concerning the reason for the competitiveness of North American dehydrated potato products although the long-term competitiveness of the American industry does not seem to have been subjected to systematic economic analysis. It has been hypothesised that the North Americans can offer a very low price dehydrated product because:

(a) the multi-product factories which are found in the United States and Canada result in low marginal costs for the raw material used to produce dehydrated products;

(b) potato production costs are much lower than in Europe;

(c) other important costs, such as energy, labour and effluent disposal, are much lower in North America;

(d) there is over-capacity in the North American dehydration sector;

(e) there is pressure on internal markets for dehydrated products, particularly with the decline in some sections of the snack product market within the United States;

(f) some traditional overseas markets for North American products, particularly in the Far East, are now subject to greater competitive pressure;

(g) there are inherent economic advantages in the simple single variety marketing system in the main potato producing and processing regions;

(h) the qualities of the Russet Burbank variety make for lower costs and a better quality product;

(i) government subsidies or aids have given the North American manufacturers some advantages and surplus production is 'dumped' in European markets.

A number of these factors are probably contributing to the present situation although no-one seems particularly clear as to how long-term this threat might be. It is important to establish how transitory are the factors which are causing the current inflow of North American products into Europe because competitive pressure from this quarter is not a new phenomenon. There is a need for a detailed economic appraisal of the long-term competitive position of the European industry compared to its North American competitors. The East European situation also needs to be closely examined in view of the recent investment in quite sophisticated dehydration facilities in Poland.

Because of the relatively low costs of transport compared to many other potato products there is a significant amount of trade in granules and flakes within the EEC. Major trade flows include: exports from the Netherlands to West Germany and the United Kingdom; from West Germany to Italy; from France to West Germany, Belgium/Luxembourg and Italy; and from the United Kingdom to Ireland (established exports from Ireland to the United Kingdom have now ceased).

One bright feature with respect to the market for potato granules and flakes is the growth in the manufacture of snacks from dehydrated potato. In some countries this market has grown quite substantially and provided a useful additional market outlet. Development of this market in Europe is several years behind its development in the United States. However there seems good reason to believe that the European market will not suffer the same kind of contraction as the North American, if only because crisps and fabricated crisps are produced by the same organisations in Europe. Flakes and granules are competing with maize flour in this market although it is readily accepted that flakes and granules produce a superior, better-tasting product.

Unlike crisp manufacturers, those organisations which produce dehydrated potato products are unlikely to be distributing their product direct to retailers. For this market they will probably be using the conventional food wholesaling channels although there is every likelihood that they will be selling to institutional and industrial users on a direct basis.

Sales at the retail level have a very strong brand orientation and this is backed up by heavy advertising and sales promotion budgets. There have been various attempts at introducing product plusses such as added butter, milk or vitamins. In addition product diversification has involved the inclusion of a number of 'tasty' ingredients such as herbs, onion and bacon. Another feature of the market is the growth of sales through the private labels of supermarkets and chain stores.

Certain quantities of potato flakes and granules are also incorporated in the potato Klösse products which are used in West Germany, although as was indicated in Section II, Klösse and Knödel products can also be made from raw dehydrated potato and from a combination of cooked and raw dehydrated potato. The manufacture of these other dehydrated products will now be considered.

(b) DEHYDRATED POTATOES, KLÖSSE AND KNÖDEL

The size of the market for dehydrated pieces is small in comparison to the other major potato processing sectors. However, it is important in the supply of dehydrated potato for the manufacture of Klösse and Knödel products which contain dehydrated raw potato. This latter market is limited to West Germany in the EEC and even in that country demand varies quite considerably from region to region with the greatest interest in these products being shown in Bavaria.

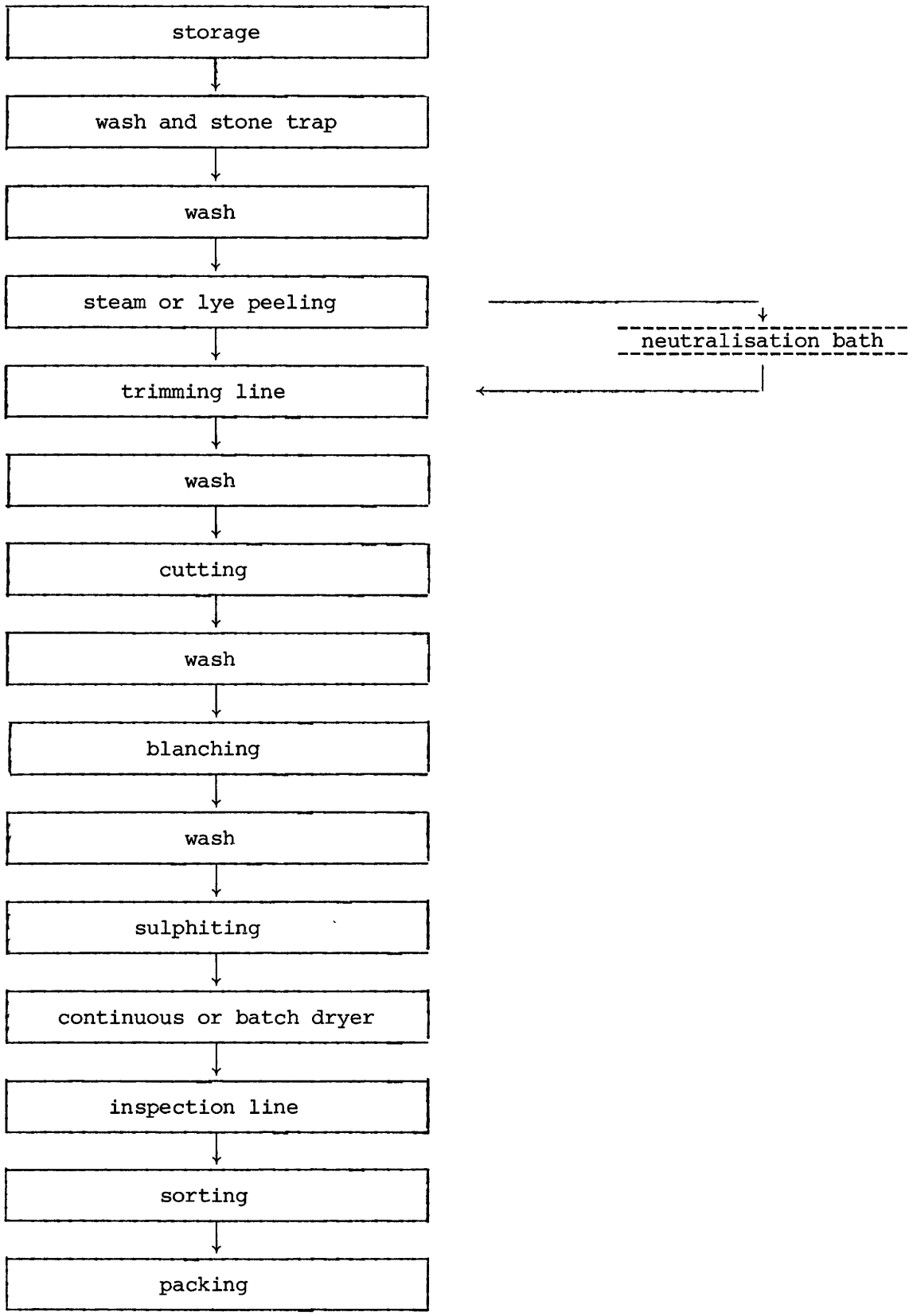
The procurement of potatoes for the manufacture of dehydrated potatoes, Klösse and Knödel does not deserve separate consideration as, to all intents and purposes, the procedures and problems are the same as for purchasing potatoes for the manufacture of granules and flakes. There is only a very small number of organisations producing these dehydrated products. They include Pfanni, Nähr Engel and Brückner in West Germany, Preservenbedrijf in the Netherlands and Swel in the United Kingdom. Some of the other granule or flake manufacturers may also produce the cooked Klösse or Knödel and there are a number of other smaller organisations which are also manufacturing dehydrated potato pieces.

The manufacturing process

The following diagram indicates the procedure for the processing of dehydrated potatoes. The process follows exactly the same stages as that used in the manufacture of granules and flakes until the point at which blanching is completed. The potatoes may be in slices, strips or cubes at this stage depending on the end utilisation. After blanching the potatoes are washed in order to free the cut surfaces from any starch which might cause adhesion during drying. There are various forms of driers although continuous belt driers would be the most common. These have greater flexibility and it is easy to control the temperature, volume of air and degree of recirculation necessary to achieve the desired quality of product.

The drying process can be divided into three stages. During the first stages of dehydration, moisture is removed rapidly. At this stage there is a concentration of moisture on the surface as water from inside the potato pieces is brought to the surface by capillaries. High humidity has to be maintained to prevent the collapse of the capillaries. When the surface dries the second stage of drying begins with the transfer of surface heat to the middle of the potato piece. The temperature is lowered at this stage to avoid non-enzymic reaction. The third stage has to be carried out very carefully as the concentration of reactants within the potato tissue is much higher and consequently the rate of moisture removal is carried out at a much slower rate. The first stage involves a drop in the moisture content from roughly 80 per cent to 25-35 per cent at temperatures from 135°C to 80°C and the time involved is usually about one hour. The second phase involves a reduction of moisture content to 10-15 per cent and it usually involves 2-3 hours at 60-70°C. The final stage may require 4-8 hours in order to reduce the moisture content to the final desired levels (approximately 8-10 per cent).

Manufacture of dehydrated potato pieces



(5)

After the drying the pieces are sieved and visually inspected before going for storage or packing. Electronic sorting machines are often utilised at this stage for removal of defective pieces. The dried potatoes are subject to exactly the same storage problems as other dehydrated products and consequently the same additives may be used during the process. Particularly important is the use of sulphite to permit use of higher temperatures during dehydration, which in this case, not only protects the product from non-enzymic discoloration but also affects the rate of rehydration of the final product (the rate of rehydration is closely related to the rate of dehydration). For the production of raw Klösse and Knödel the dehydrated potato is ground and various ingredients are combined such as starch, herbs and seasonings. Cooked dehydrated products (i.e. granules or flakes) may also be incorporated with the raw dehydrated potato to form half and half Klösse and Knödel products or they may be used independently for cooked Klösse and Knödel.

Marketing considerations

As dehydrated potato pieces are not sold directly to consumers but are an intermediary product, the market depends very much on the derived demand for the wide range of products in which it is included. The demand for some of these products is extremely seasonal as is the case for those potato pieces included in soups. Perhaps the most important segment of the market is the use of dehydrated potato for Klösse and Knödel. These are traditional German dishes which are found in several German-speaking countries and they are not always made of potatoes. However, they belong to that part of the meal which has traditionally played the role of filling the stomach and consequently the quantity consumed has decreased as incomes rise, in the same way as demand for fresh potatoes has declined. The market for dehydrated Klösse and Knödel was built on the convenience of an easily prepared product and proved to be a great success in the same way as instant mashed potato products. In order to maintain demand for a product which is so traditionally based, the principal manufacturing companies have set about presenting the traditional product in a range of new forms and to encourage consumers to experiment with new Klösse and Knödel.

Like many other grocery products it is advantageous to maintain a fairly stable price to keep the support of regular customers. Although potato prices might change quite significantly from year to year it is not possible to vary the retail price in the same way, and consequently fixed price contracts are required for a large proportion of the raw material.

Distribution of such products would be carried out in exactly the same way as for potato granules and flakes sold through retail outlets.

Most of the organisations which are preparing dehydrated Klösse and Knödel manufacture their own dehydrated potato pieces and granules or flakes. The other buyers of dehydrated potato pieces are incorporating them into other products and consequently most of the distribution will be done in bulk and sales will be on the basis of contractual arrangements. The possibility of bulk trade with relatively low transport costs has meant that the EEC market has been subject to a number of intrusions from outside. In particular there have been dehydrated potato pieces from Eastern Europe (Poland in particular) offered at very competitive prices and this represents a serious problem for some of the manufacturers.

THE MANUFACTURER OF FRENCH FRIES AND OTHER FRIED NON-SNACK PRODUCTS

The fried non-snack products sector is perhaps the most difficult to consider in terms of the problems faced by the individual manufacturers. The crisp and dehydrated potato product sectors were dominated by a few large organisations but the fried non-snack products sector comprises a fairly large number of firms operating on various scales and producing a range of different products. Consequently, individual circumstances differ quite significantly and generalisations become difficult.

The manufacturing process is fairly straightforward and as a result it has been possible for a number of smaller organisations to embark upon the manufacture of french fries for local markets without investing heavily in capital. Unlike crisps (the manufacture of which is similar) distribution is relatively straightforward and local markets can sustain small manufacturers. In addition the market power of established brands is much lower than in the crisp sector and it is easier to produce an acceptable french fry product than it is to produce an acceptable crisp. Ease of entry into the manufacture of dehydrated potato products is much more difficult. It involves a substantial level of investment and the utilisation of some difficult techniques (often protected by patent) to overcome the major problems of producing a good quality product.

In order to simplify the task of outlining the main components of the business the sector has been considered from the viewpoint of an industrial-scale manufacturer of french fries. As the bulk of the french fry market is supplied from large scale manufacturers this is not a very limiting simplification, neither does it exclude from consideration the production of other fried non-snack products because most of these also originate from the factories of the larger french fry manufacturers.

French fries can be sold in either frozen or chilled form, and the distinction is an important one, for the characteristics of the two markets are very different. The basic manufacturing process is similar with the principal difference being the treatment of the product after it leaves the fryer. Several firms are involved in manufacturing both deep-frozen and chilled products, especially in the Netherlands and West Germany. Like the products which have been considered before, this section will deal with the raw material requirements, the manufacturing process and some considerations of the market. Similar to the crisp and dehydrated potato industries, the raw material costs represent a very significant proportion of the total manufacturing costs and the variability of potato prices can introduce many difficulties for the manufacturer. Consequently, the procurement of the raw material represents a very important part of the entire business. This is emphasised by the fact that many of those organisations which are currently prominent in the manufacture of french fries have at some stage been involved in trading in potatoes. In fact it is commonly said that one aspect of the french fry sector which distinguishes it from other potato processing sectors within the EEC is the fact that it comprises, for the most part, processing operations run by wholesalers (including co-operatives). Whilst this is perhaps a slight exaggeration to make a point and the situation is gradually changing, it represents an accurate statement of the historical development of a large part of the french fry sector within the Community. The gradual involvement of 'outsiders' does not mean to say that the skills of raw material procurement have become any less important, but perhaps recent developments have seen greater emphasis upon the manufacturing process itself and upon the problems of marketing. This is apparent

with the development of branding operations in this market and the attempts to meet the increasingly specific requirements of certain sectors of the market by small, but important, adjustments in the manufacturing process. However, the developments in the market and in the manufacturing process can never be considered in isolation from the raw material and it is often felt, especially by North American observers, that the overall quality of the raw material available in Europe limits the potential for market development on the same basis as in the United States.

The market for frozen french fry potatoes has been expanding fairly rapidly in recent years in almost every country of the EEC. However, the level of demand has still not reached the level experienced in the United States. The demand for chilled french fries is much more variable and it is also more closely related to the price of fresh potatoes.

Whilst the concentration of ownership of this sector is much less than occurs in the crisp and dehydrated potato products sector there are still a number of very large organisations. A fairly large proportion of the total output would be accounted for in the United Kingdom by Potato and Allied Services and McCains, in the Netherlands by McCains, Aviko, van Tuyl, Farm Frites and Vriezo; in West Germany by Schnetkamp, Stöver, Du Frit, Friba and Wernsing, in France by Bonduelle and Vico; and in Belgium by Van den Broeke. Denmark and Italy have very small sectors and Ireland and Luxembourg, as yet, have no industrial manufacturers at all, although there are some plans for a relatively small plant to be established in Ireland.

Raw material procurement

In very general terms the manufacturer of french fries wants a potato with a relatively high dry matter content, (at least 20 per cent dry matter), a reducing sugar content below 0.25 per cent, a regularly shaped potato preferably of a long oval form, and larger sized tubers, usually from 50mm upwards, without any external or internal defects which might lead to expensive losses. Like other processors, french fry manufacturers require potatoes with a low tendency to discolour, either from enzymic oxidation or after-cooking discoloration. Flesh colour requirements vary, with those countries which traditionally have had ware markets dominated by white fleshed varieties (i.e. the United Kingdom and Ireland) preferring a white coloured flesh for their french fries.

It is perhaps easier to generalise about the varieties required by the manufacturers of french fries than any of the other sectors. The variety Bintje, which is commonly found on the ware markets of the Netherlands, Belgium/Luxembourg, France, and Denmark, is recognised as a variety which is extremely suitable for the manufacture of french fries. Consequently, this variety is widely used in the french fries industry of these countries and is also exported to many of the manufacturers of french fries in West Germany. The requirements of the ware market and french fry manufacturers' market complement each other well because the french fry manufacturers want only large potatoes and the ware market requires only medium sized.

In the earlier section it was shown that environmental factors can play a very substantial part in the determination of the quality of potatoes. A very good illustration of the influence of these factors occurs in the french fry industry, for despite the substantial demand for Bintje potatoes in West Germany it is extremely difficult to reproduce the quality

of Bintje grown on Dutch clay soils in West Germany except in a limited number of locations. It seems as though the soils and environment found in the clay soils in the west of the Netherlands combine with the variety Bintje to produce a potato which is not only very suitable for the manufacture of french fries but which is also remarkably consistent in quality from year to year. Indeed it is this consistency of quality which has perhaps been the most important factor in the development of Dutch exports to the West German market. Although Bintje is grown in Belgium and France there are some instances of the manufacturers in these countries also importing Dutch Bintje, again mainly because of the availability of consistent quality from that country. However, it would be wrong to ascribe all of the development of exports of Bintje from the Netherlands to the inherent qualities of the variety, for another important factor has been the way in which the Dutch potato marketing system has responded to the requirements of a newly developing industry.

With the importation of fairly large quantities of potatoes for processing into West Germany there has been every incentive for the West German potato marketing system to produce either domestically grown Bintje or else to produce other suitable varieties. Despite every effort of the West German authorities to promote West German varieties and to encourage domestic production, most larger processors show a marked reluctance to move away from a fairly substantial reliance upon Dutch supplies. Indeed some of those who have moved away from Dutch supplies because of aids to establish domestically based producer groups have now returned. There are some notable exceptions and one or two major processors have established their own domestic arrangements for supplying Bintje from those areas with suitable soils. In addition many of the smaller fresh french fry manufacturers are buying off the West German ware market and other German grown varieties (such as Ostara and Climax) are used to supply the gap during the summer between old crop Bintje and new crop Bintje. The manufacturers of french fries in Italy rely to a quite considerable extent on Bintje from France and the Netherlands to supply their requirements during the winter and spring months. The requirements during the early part of the season are met from local supplies with varieties such as Primura and Ostara being used as earlies and Vivaks, Resy and Spunta during the autumn and early winter.

Development of the industry in the United Kingdom and Ireland has been very different mainly because of the geographical separation from the Bintje producing areas of Europe, reinforced by the ban on the importation of maincrop potatoes into these two countries. This has restricted the development of Dutch sales and consequently the major processors have had to rely on varieties which are cultivated for the home ware market. The principal varieties utilised for french fry manufacture are Pentland Dell, Maris Piper, Pentland Crown, Pentland Hawk, Pentland Ivory and Pentland Squire. Of these Pentland Dell is the preferred variety.

To a large extent the potato procurement methods adopted in the french fry sector are affected by the same factors operating in the other two major product sectors. There is a very wide range of different procurement methods adopted within the industry and significant variations between countries. The manufacturers of french fries have a number of alternatives open to them. They can set out to grow their own potatoes, they can purchase potatoes on the free market or they can purchase potatoes through a variety of contractual arrangements. A number of processors have taken

the option of growing at least a part of their potatoes on rented land or land which they own in order to ensure themselves a proportion of their supplies at a predictable cost. However, this option takes them into areas of activity which involve the application of new skills and the shouldering of extra risks and represents a significant widening of the nature of the business. Consequently, if one excludes the cooperative processors, the number of manufacturers who have taken this option, even for a part of their supplies, remains relatively small.

Suitable quality raw material is considered to be available from the ware market in some countries. However, buying potatoes from the ware market can have its drawbacks. Firstly there may be problems with the quality of potatoes bought on the open market, especially at the end of the storage season and in those countries where not enough attention is paid to storage. This may lead to processors chasing the small proportion of the suitable potatoes left in store at inflated prices. It is essential that a processor is guaranteed a supply of raw material to his factory so that expensive machinery and labour can be kept fully occupied.

Second, the price of potatoes on the ware market is very unstable both between and within seasons and this can produce problems for manufacturers because not all these raw material increases can be passed on to their customers. In particular a manufacturer might have obligations to supply customers on fixed price contracts or he may also be restricted in his ability to pass on price increases by his desire to establish a product brand on the market on the basis of a stable price policy. This may well apply to some of the processors who are selling high grades of french fries and fried products.

To overcome these problems manufacturers use a variety of contractual arrangements for the supply of raw material. In particular, fixed price contracts for the supply of potatoes can give cover to the contractual commitments in the product market and other forms of contract can guarantee raw material supply throughout the season. Among these other forms of contract, participation contracts have become particularly important. The nature of these vary but often they offer to farmers a slightly lower basic contract price in return for allowing them the advantages of sharing the benefits if ware prices move any higher. Such contracts are particularly attractive to farmers who are often reluctant to participate in fixed price contracts in a volatile market.

Taking out fixed price contracts gives the manufacturer the opportunity of adjusting the level of risk he wishes to expose himself to. Through contracts, processors can take various degrees of cover of fixed price contractual sales of products. For example, if a manufacturer takes a view that market prices will be low, he may wish to take out a very low degree of cover leaving himself free to purchase his raw material at a much lower price should his speculative view be proved correct. Similarly if he considers prices are going to be high he will take out more potato contracts than he needs to cover his contractual obligations.

In the Netherlands it would be most unusual for the manufacturers of french fries to contract directly with producers, as the supply of Dutch Bintje is organised almost exclusively through private wholesalers and cooperatives. As explained earlier, wholesalers and cooperatives play a

central role in the Dutch potato marketing system, procuring a large part of the crop and sorting it into size fractions appropriate for different utilisations. They procure from farmers in the same way as outlined above and then sell to processors on fixed price contracts and at free market prices.

However, in those countries where suitable raw material is not always available on the ware market the only way to procure is by establishing separate sources of supply through contracts with producers. This is common in Denmark and Italy and in some parts of France and West Germany. The establishment of such direct sources of supply has given the manufacturers of french fries the means of influencing quality in these countries. The West German situation is particularly interesting because many of the manufacturers of french fries are well within the reach of Dutch wholesalers and consequently suitable quality raw material is available on the ware market. However, some feel vulnerable relying on Dutch supplies and every effort has been made to establish their own sources of Bintje supply as far as their soils will allow them.

As the french fry industry only takes large potatoes the establishment of direct sources of supply, such as through a producer group or direct contracts with growers, has other implications, for the remainder of the crop has to be disposed of. Because the varieties used for french fry manufacture are also very acceptable on the ware market; this is not a difficult problem, although it does mean that the grower or producer group has to establish other market outlets, which means they have to adopt a wider responsibility for marketing potatoes. It has been noted before that the Marktstrukturgesetz in West Germany can offer a number of incentives to producers and processors alike for the establishment of producer groups. These incentives have played an important function in orientating some producers towards domestic sources of supply of raw material.

In France and Belgium, Bintje is available on the ware market and some of these potatoes are used for french fry manufacture. However in these two countries a number of manufacturers have grown potatoes themselves or organised their own supply systems through cooperatives and producer groups in an attempt to maintain control over quality. Even so, there is some evidence that the consistency of the quality of this raw material is poor and consequently some are moving back to purchasing raw material from the more consistent Dutch clay soils. In any case it has been difficult to get farmers in these two countries to accept contractual arrangements in a part of their farm business which has always been so speculative.

One of the organisations producing french fries in France is in fact a cooperative and it is perhaps important not to forget the position of such organisations when making the kind of broad brush generalisations which are being attempted in this section. In this case supplies come almost exclusively from members. A cooperative can rely upon members for a large proportion of its supply although in order to operate flexibly as the market demands, they must also have the facility to trade in potatoes so that they might buy and sell as and when it is necessary. There are several other cooperatives producing french fries in Europe and one of the largest European manufacturers is independently owned, although to all intents and purposes this organisation operates in the same way as a private manufacturer.

Italian processors will buy on contract from local growers and traders during the early part of the season, but later they must rely on contracts with wholesale or cooperative suppliers of Bintje from France and the Netherlands. Danish supplies for the french fry sector are bought almost exclusively on direct contracts with growers, again to ensure quality.

In the United Kingdom processors have purchased their supplies from a wide range of different sources. These include individual producers, merchants and cooperatives. The particular method chosen depends on the policy of the company, some preferring to maintain close links with individual growers and thereby maintain an opportunity to influence the quality of supplies and others preferring to accept material which could be procured by merchants or organised by cooperatives. Dealing through merchants and cooperatives simplifies the procurement of raw material, especially when large quantities are required.

It is inconceivable that one should leave the subject of contracts without discussing the problems of contracts being broken by either party. Unfortunately disputes about broken contracts occur fairly frequently in the potato sector mainly because of the very unstable price conditions. The situation came to a head in the years of 1975 and 1976 when ware prices went to extremely high levels and manufacturers found great difficulty in getting farmers to meet their contractual obligations. Friction between processors and their suppliers occurred throughout Europe in that season and it would be wrong to suggest that problems were greater in one country than in any other. The availability of participation contracts can overcome some of these problems but participation contracts do not always meet the needs of manufacturers and consequently fixed price contracts still have a role to play. Essentially the situation can be improved by making growers aware of the importance of contracts to the operations of the manufacturer and also the formulation of contracts so that it is easier for either party to take legal sanctions when necessary. Many farmers and suppliers do not believe that manufacturers are completely blameless and it is not difficult to find suppliers who claim that loads have been rejected because of market prices falling. It is futile to speculate which party is more to blame but it is important to recognise that such difficulties do exist. A factor which has contributed to the situation has been the problems of defining potato quality and hence great care must be taken in drawing up contracts and in establishing procedures to assess whether or not contract conditions have been met.

Contractual conditions vary from organisation to organisation, although when buying from conventional trade channels the minimum quality specifications would follow those laid down in the RUCIP rules of international trade in potatoes or in the equivalent national ware standards. Purchasers may add their own particular specifications should they consider that this is necessary. Some organisations feel that a specification of dry matter content is important whilst others are content to specify variety. Some organisations may specify sugar content although this is unusual in the french fry sector. The temperature during storage and at delivery is occasionally specified. Some manufacturers consider the latter to be a very important contract condition, especially when purchasing potatoes from Dutch clay soils as these are considered more vulnerable to blackspot if temperature falls below 12°C during transport.

In the Netherlands there has been an attempt to set up a national system of payment on the basis of the suitability of the raw material for the manufacture of french fries. The representative organisations of the processors (Vereniging voor de Aardappelverwerkende Industrie, VAVI) and the wholesalers (Vereeniging ter Behartiging van den Nederlandschen Aardappelhandel, VBNA) combined to put forward proposals for the establishment of a system of objective measurement and classification of potato quality. This exists at two levels, firstly between producers and wholesalers and secondly between wholesalers and processors. The success of the scheme has been much greater at the first level than at the second and it seems as though the efforts to introduce model contracts between wholesalers and processors has now been put on one side. However the concept is an extremely interesting one from the manufacturers' point of view as it means that farmers are given the incentive to produce potatoes of the quality desired for the manufacture of french fries.

Certain institutional factors have affected the ability of some organisations to contract to the extent that they would have desired. In particular the arrangements in Great Britain for the regulation of the potato market through the Potato Marketing Board have represented a problem for some processors. The Government under-written scheme has given to producers some form of assurance which in other countries would only be obtained through fixed price contracts to processors. Consequently the advantages of contracts with processors have been less clear cut for British producers.

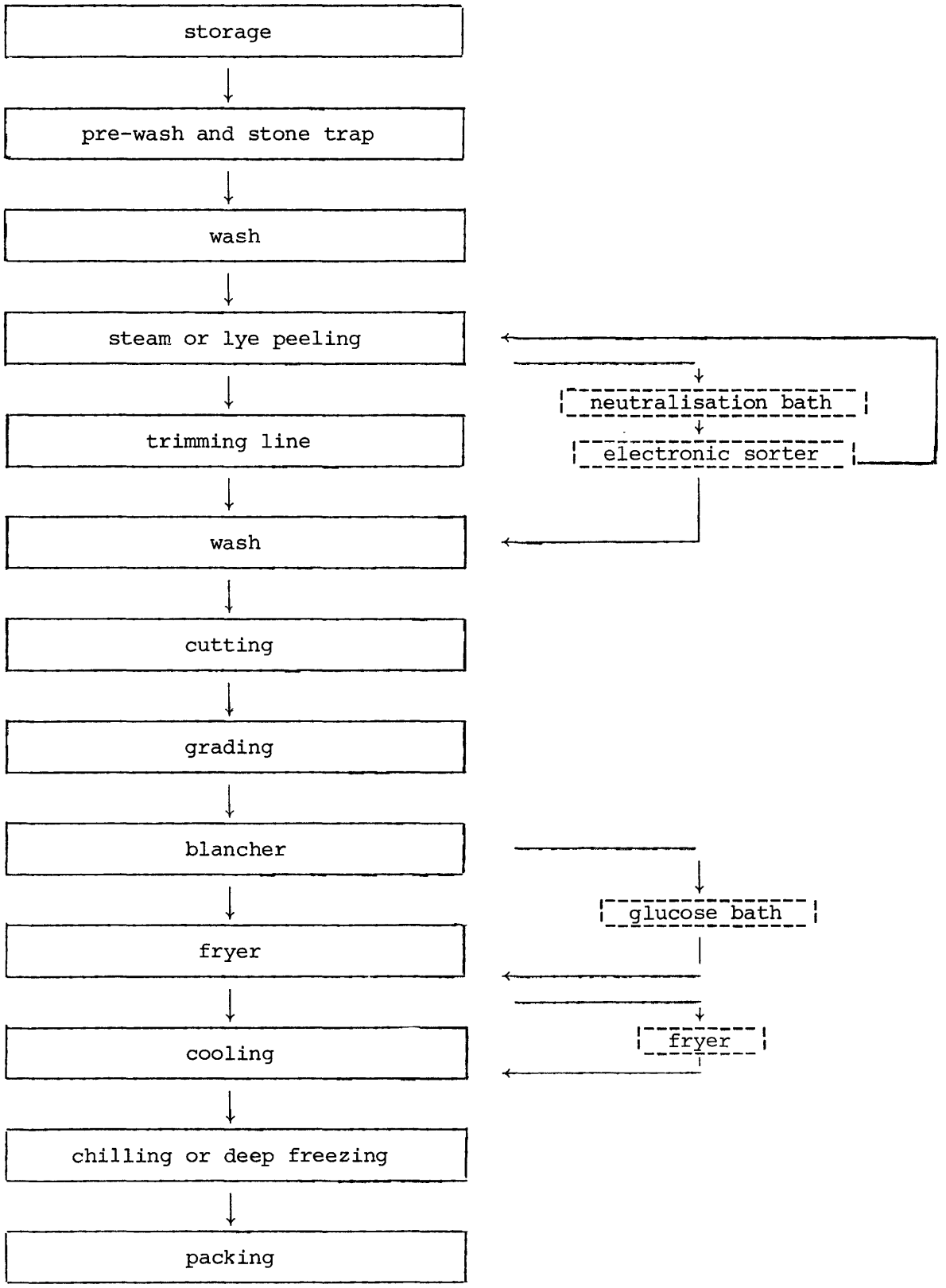
The contract negotiation patterns used in the french fry industry vary quite considerably and resemble the range of methods outlined in the previous sections for the other potato processing sectors.

The manufacturing process

The main stages in the manufacturing process are shown in the following diagram. Potatoes move from storage and through similar washing, peeling and trimming routines to those used in the manufacture of dehydrated potato products. Peel losses when preparing potatoes for the manufacture of french fries are slightly higher than for crisps, granules or flakes because pieces of peel remaining on the tuber can quite seriously affect the presentation of the product. Peeling is done either by lye or steam procedures as described for dehydrated potato flakes and granules. Abrasion peeling is rarely used as much higher losses result from a complete peel of the potato. Steam peeling is more common in those countries of continental Europe where peelings are used for animal feed. In the United Kingdom lye peeling is more common.

The tubers are trimmed and cut into strips. For market presentation purposes it is desirable to have fairly long uniformed size french fries. This quality may be obtained by grading the cut potatoes or alternatively by using special cutting machines. These machines shape the tubers into uniformed size blocks along the long axis of the potato which, when cut on the same axis, produce long cuts which are very regularly shaped. The process of peeling, trimming and cutting results in fairly substantial losses for the french fry manufacturer. The size of these losses depends on the quality of the potatoes which are used as raw material. Weaver, Reeve and Kueneman (in Smith, 1975) suggest that in the United States peeling and trimming losses can fall within the range of 15 to 40 per cent,

Manufacture of french fries



and that grading out the slithers and nubbins can involve an extra loss of 10 per cent. These may be slightly higher losses than incurred in Europe because quality standards in North America are generally much higher, although to counter-balance this the raw material quality is likely to be better. The strips of potato are washed after cutting to remove any surface starch which may cause adhesion during frying.

Before frying the product is blanched, a procedure which has to some extent replaced the requirement to condition potatoes prior to processing, although conditioning is still practiced by a number of manufacturers. Hot water (or steam) blanching not only removes some of the sugars in the potato strips (and therefore gives a more uniform coloured product) but also it reduces fat absorption during frying by creating a heat ring of gelatinised starch on the surface of the potato strip and reduces frying time. It has also been observed that the product texture is improved as a result of the blanching process. Some manufacturers may use two blanchers which give slightly more flexibility. In this second blanching process it is possible to add glucose if sugars are low and create a more uniform colour if required. Also a chelating agent which inhibits after-cooking discoloration may be added if this is a problem.

The raw french fries are then partially dried, usually by mechanical shaking in a draught of warm air, in order to reduce the frying time and the quantity of oil absorbed into the product. The degree of drying varies between the different manufacturers; some preferring to drive off fairly large percentages of the moisture content of the potato strips, others being content to get rid of surface moisture. Generally if moisture content is reduced before frying then frying time is reduced and less fat is absorbed. With a growing demand for low fat content french fries, the drying process is becoming more important in the manufacturing process.

The frying of french fries is carried out in a similar way to the frying of crisps. The aim is to partially fry the strips of potato in oil to produce a product which can be finish-fried or finish-heated close to the point of consumption. The requirements of users may influence the precise production methods used. Longer periods of par-frying result in more weight loss at the plant and more oil uptake but it means that french fries can be finish-fried at the catering establishment in a rather shorter time. If trends follow those of the United States, and there seems every indication that they will, the major purchasers of french fries will become more and more specific about their requirements.

In the frying process the manufacturer needs to keep very close control over the frying time and the temperature of frying in order to maintain the desired quality and reduce losses. Like the crisp manufacturer, he is also concerned to maintain oil quality by suitable oil housekeeping practices.

After frying the french fries are shaken and passed through a current of hot air to remove excess fat. They are then cooled and inspected before being chilled or frozen.

Freezing is usually carried out on fluidised bed freezers in which the french fries flow on a cushion of air at -40°C for about 12 minutes. Freezing must be done rapidly to maintain quality. After chilling or freezing the french fries are packed into a variety of different pack sizes.

The frozen product can be kept in storage for several months at a temperature of -18°C without any quality deterioration. The chilled product (usually chilled to 4-5°C) has a shelf life which is very dependent upon temperature. At 5° they can be kept for four days and the shelf life reduces by one day with every increase of 5° in the storage temperature.

There are several developments in the product line which have meant slight adjustments in the manufacturing process. In particular french fries are now produced which can be prepared for consumption by heating in an oven. This product is produced by modifying the blanching, drying and frying processes.

The losses incurred during the manufacturing process can amount to anything between 50 and 65 per cent of the weight of the raw potatoes used. To some extent these losses can be reduced by utilising as much of the discarded material as possible. In some cases the graded-out potato strips can be used in the preparation of other par-fried products or the manufacture of other potato products which are subjected to other cooking processes before freezing. Some manufacturers find it difficult to use this material and consequently it serves as waste which normally would be sold as animal feed.

The principal cost to the manufacturer of french fries is the cost of raw material; other significant costs are oil for the fryer, labour for trimming, inspection and packaging and energy for frying and freezing.

Marketing considerations

French fries are sold to a number of different markets and the characteristics of these differ quite considerably. Frozen french fries are sold principally to the catering trade although an important retail trade has been developed. The largest proportion of these sales would be conducted through wholesalers who specialise in handling deep-frozen goods although a few organisations do their own distribution. The distribution of frozen food involves substantial investment in the necessary stores and transport as well as extending the area of responsibility of the potato processing business. Because of the levels of investment needed, there are a number of very large companies who play an important part in the distribution of frozen food such as the subsidiary companies of Unilever and Nestlé who operate in every EEC country. These large frozen food distribution companies are extremely strong in the retail market and a significant proportion of the product coming onto the retail market will bear the brand names of the large distributor rather than the manufacturer. Some firms do not sell under their own brand labels preferring to sell instead to large frozen food distributors whose established brand names put them in a powerful position. It also means that the processor can concentrate more on the production process and leave at least part of the marketing and distribution worries to the frozen food distributors.

Those french fry manufacturers who are producing chilled french fries are faced with a demanding distribution problem because the shelf life is so limited; it is usual for them to handle their own daily distribution to their customers. As a result many of those organisations who are producing chilled french fries are serving only a very local area, although some of

the larger manufacturers have a transport fleet and are consequently able to cover fairly large distances on a regular basis.

The manufacturer of deep-frozen french fries is in a position to distribute his products over much larger areas and fairly large quantities of frozen french fries are traded internationally. By far the largest exporting country is the Netherlands which has developed markets in each of the other EEC countries. West German and British manufacturers have also established important markets in other EEC countries. The demand for frozen french fries derives from an increased demand for convenience foods which was discussed in an earlier section on dehydrated potato products. Other contributing factors have been the continuing growth in the number of meals eaten outside the home, the growth of freezer ownership and the development of the frozen food distribution channels. A relatively new factor has been the growth of fast food restaurants, often North American in origin, which often include french fries as an important part of their marketing mix. These organisations have a very high quality specification and they represent an important new market for french fry manufacturers.

It is easy to distinguish between the high quality market, which is not very sensitive to price changes but is very sensitive to variations in quality, and the lower quality market which has a less specific product quality requirement but where price is much more important. However, the development of the European market for french fries is still in its infancy compared to the North American market. Standard national grades have been in existence since 1954 in North America and these reflect the different types of demand which exist in the market. All the indications would seem to suggest that the European market will move in a similar direction as the separate quality markets become more and more distinct. Today most major manufacturers will be producing a quite significant proportion of their output on the basis of the specification of their customers and it seems highly likely that more customers will demand separate specification in the future.

In sharp contrast to the rapidly rising demand for frozen french fries, the demand for chilled seems to be on the decline. In West Germany, where demand for chilled french fries is greatest, small manufacturers are under increasing pressure from larger organisations and are finding it more difficult to meet very stringent requirements of national hygiene and environmental regulations. The demand for these products is very seasonal with a big upsurge in summer months when people are on holiday.

Oven prepared french fries have been launched on a number of European markets. They appear to have a promising future as it relieves the cook of a relatively unpleasant and sometimes dangerous task. There also seems to be quite substantial potential in some countries to improve the overall quality of fried potatoes by the use of the frozen product and some manufacturers look upon future developments fairly optimistically.

THE MANUFACTURER OF PRESERVED POTATO PRODUCTS

The most important forms of preserving potatoes in this category are canning and bottling. Some aspects of the canning and bottling business will be discussed in very broad outline as more detailed consideration is not justified by the size of the industry when compared with other forms of potato processing. The raw material requirements are very specific to produce a good quality product and although the manufacturing process is fairly straightforward the canning or bottling of potatoes is often combined with other canning activities which together represent a fairly difficult management operation. The final product is sold into retail and catering outlets through conventional distribution channels. The canning or bottling of potatoes is carried out by a fairly large number of firms, most of whom will be involved in preserving other vegetables or fruit. The quantity of potatoes involved is modest in comparison to the other potato processing sectors and it is a product purchased by a relatively small market segment. In the United Kingdom a canned potato salad is an important product for which the raw material requirement is different. In addition to canning and bottling there are other preserved potato products on the European market. In France potatoes are sterilised and sold in vacuum packs and in Germany a Rösti product is sold packed in an inert gas. There is also a french fry product packed in a vacuum sold in Italy. At the time of writing each of these products represent relatively small markets in comparison to other forms of potato processing and consequently they will not be considered in detail in this report.

Raw material procurement

Canners and bottlers require potatoes which are small in size (roughly 20mm to 40mm), with a low dry matter content, resistance to enzymic oxidation and after-cooking darkening, a round oval shape with shallow eyes and free of blemishes. The low dry matter content potatoes are required for their firm cooking qualities and their firm waxy texture.

In West Germany the principal variety bottled is Hansa which is one of the most common varieties on the ware market, particularly in the north and west of the country. Consequently, there are few problems in West Germany identifying sources of raw material, for outgrades from the ware sample can fairly easily be procured from conventional ware market channels. In the United Kingdom the main varieties are the early varieties Arran Comet, Duke of York and Maris Peer which are usually purchased on contracts direct from growers. King Edwards have been used and this variety is used by the canner in Ireland. Some maincrop varieties are canned in the United Kingdom with the raw material being supplied from the outgrades of the ware crop. The quality of these potatoes is less suitable for canning but for certain catering uses may be perfectly adequate if specific gravity is not too high. In the other countries of Europe there is some canning of outgrades from the ware market although high dry matter content is often a problem and consequently in these countries the emphasis will be upon canning immature potatoes during the summer.

The raw material is normally procured on contract from a wide range of different sources. Wholesalers and cooperatives may be important when buying varieties which are sold on the ware market, especially where outgrades from the ware market can be suitably canned, or, alternatively, contracts

may be taken out with individual growers or with groups of growers when the requirements are more specific.

The manufacturing process

The following diagram indicates the main elements in the canning or bottling procedure. As with the other methods of processing the preliminary stages involve washing, peeling and trimming. Peeling can be done by either abrasion, steam or lye peelers and this stage of the operation can involve very heavy losses because the final product must be completely without peel. Occasionally abrasion peelers are used to shape the potatoes, in which case the losses are even greater. Potatoes are then washed, placed in the containers, usually by automatic equipment, and either boiling water or brine is added to fill the container. The cans or bottles are then sealed and sterilised at very high temperatures and then cooled rapidly to about 35-40°C in water cooled chambers.

The major problem as far as the processors are concerned is obtaining raw material which is of suitable quality. If quality of the raw material is not good then peeling losses are very high and the trimming activity attracts even higher labour costs.

Another major problem for the processors is the avoidance of taints which become very obvious in such a bland tasting product. In some countries flavourings are added, such as mint, which can mask any taints but consumer acceptance of flavours varies from country to country. However, probably an even greater problem for many of the canners is fitting potatoes into their canning or bottling programme which will often include several other vegetables and fruits.

Marketing considerations

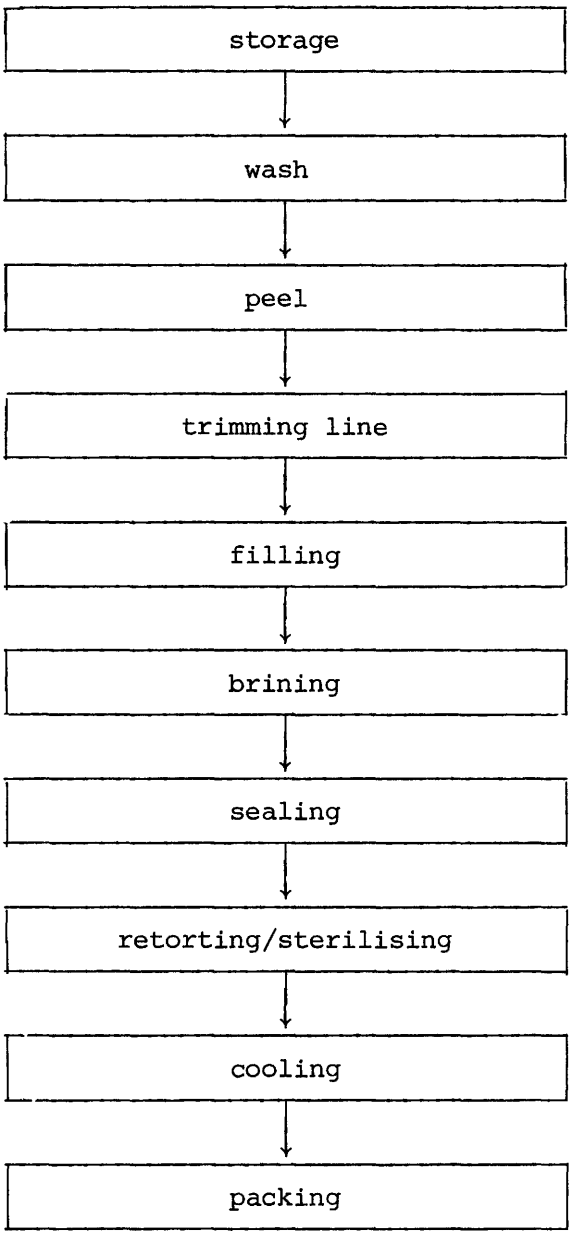
Generally canned and bottled potatoes are not very well accepted in comparison to freshly cooked potatoes and consequently it is a difficult market in which to make any headway and only meets the requirements of consumers in special circumstances. These consumers may be single people or elderly people for whom the convenience of a canned product is valued. Weight for weight the price of the canned or bottled products can be several times the price of the equivalent raw potato. In some countries the market is fairly stable and demand does not seem to be closely related to the price on the ware market.

In West Germany preserved potatoes are only sold in bottles. There is considerable consumer resistence to cans because consumers cannot see the appearance of the product.

Most of these products will be sold through convential wholesale channels to retailers and caterers, although there are some direct sales to large retailers often using the retailer's private label.

There is a modest amount of international trade in preserved potatoes, some of which reflects the different periods of availability of early potatoes for canning in certain countries.

Manufacture of canned potatoes



SECTION V: THE POTATO PROCESSING INDUSTRIES OF THE MEMBER STATES

Introduction

By means of introduction to this section Table EC1 provides an indication of the scale of potato processing in each of the nine Member States. It can be seen from this table that the manufacture of potato products is concentrated largely in West Germany, Great Britain, the Netherlands and France. Ireland, Italy, Denmark, Belgium and Luxembourg have only very small industries in comparison with the other four countries. As can be seen in the table, a large proportion of dehydrated potato products are manufactured in West Germany and indeed a large proportion of the dehydrated products manufactured in the Netherlands are also sold in that country. The Netherlands, United Kingdom and West Germany each have french fry industries which handle roughly the same volume of potatoes and the development of this sector in other countries is relatively insignificant. The potato crisp and snack sector is a comparatively minor part of the potato product's industry in most of the Member States except the United Kingdon, although the French crisp sector utilises a fairly large percentage of the total quantity of potatoes manufactured. In the United Kingdom the use of potatoes for the manufacture of crisps accounts for almost half of the total quantity of potatoes processed and this is more than is used by all the crisp sectors in the other Member States. As has been noted earlier there are a number of other miscellaneous products which are produced although these represent only a relatively minor part of the potato processing sectors of each of the Member States.

Because the potato processing industries of West Germany, the United Kingdom, the Netherlands and France are considerably larger than those of Ireland, Belgium/Luxembourg, Denmark and Italy they are considered in greater depth in this section. The differences between the two groups of countries is really quite dramatic. Those countries with only small industries are very small indeed, for example in Ireland there are only five factories producing potato products and in Belgium four, Denmark four, Italy nine and Luxembourg none (although in addition there may be a small number of canning companies processing potatoes in each country). Consequently for these latter countries little descriptive information on the potato processing industry is necessary. A broad description of the potato sector and an account of the historical development is given for each of these countries and the reasons why a larger processing sector has not developed is examined.

TABLE EC1: Production of potato products - 1978

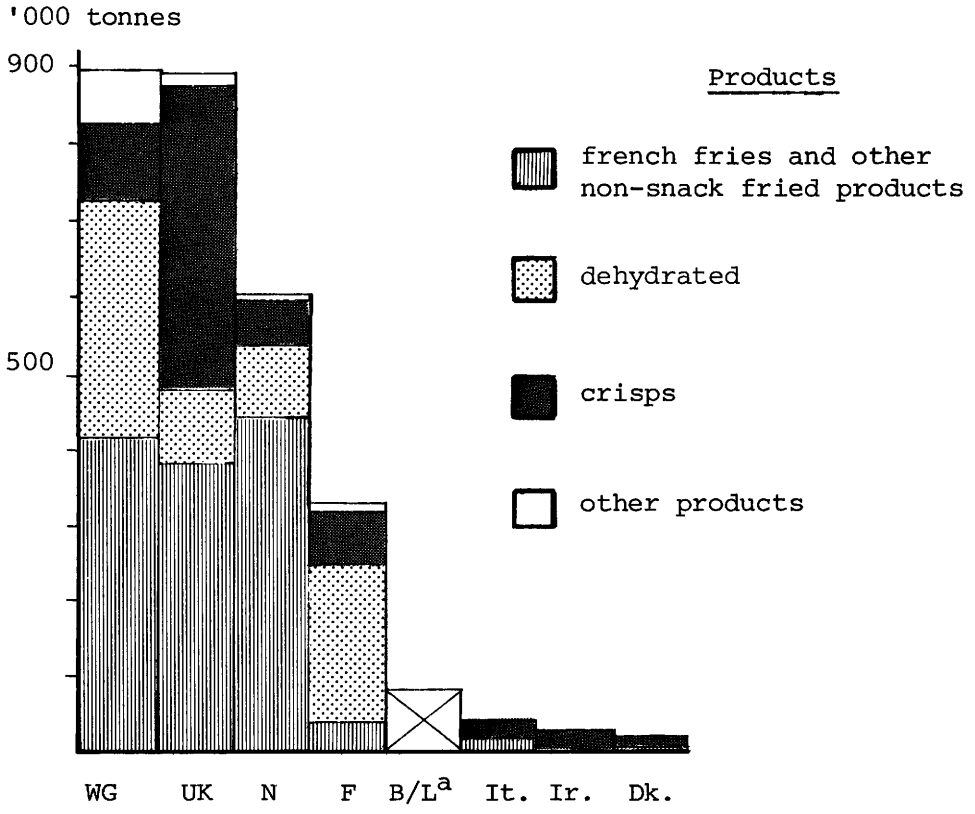
Products	Potatoes used for processing (tonnes)							
	Netherlands	United Kingdom	West Germany	France	Ireland	Italy	Denmark	Belgium/ Luxembourg
Dehydrated	97,000	98,000	311,250	201,700	-	n.a.	)	
French fries: chilled	211,000)	377,000	228,800	8,000	-		)	
deep-frozen	225,000)		183,200	31,000	-	15,000[a]	6,000[a])	80,000[a]
Crisps	63,000	400,000	101,700	71,700	29,000[a]	25,000[a]	13,000[a])	
Other products	6,000	15,000	69,800	14,600	1,000[a]	n.a.	800[b])	
Total	602,000	890,000	894,800	327,000	30,000	(40,000)	19,800	80,000

Products	Potato products (tonnes)							
	Netherlands	United Kingdom	West Germany	France	Ireland	Italy	Denmark	Belgium/ Luxembourg
Dehydrated	16,000	14,000	45,800	30,800	-	n.a.	-)	
French fries: chilled	102,000)	69,650	104,000	4,000	-		-)	
deep-frozen	117,000)		83,300	15,500	-	7,500[a]	3,000[a])	n.a.
Crisps	17,000	100,000	27,900	17,900	7,250[a]	6,250[a]	3,250[a])	
Other products	3,000	13,500	38,800	7,300	600[a]	n.a.	720[b])	
Total	255,000	297,200	299,800	75,500	7,850	(13,750)	7,000	

a author's estimates
b 1977
n.a. = not available
NB: columns do not agree with totals because of rounding

Source: UEITP.

Potatoes used for processing potato products : 1978



a crisps, french fries and dehydrated products are produced in Belgium. To maintain the confidentiality of the single firms which produce crisps and dehydrated products it is not possible to specify the quantity of products processed.

Source: See Table EC1.

(i) THE POTATO PROCESSING INDUSTRY OF THE NETHERLANDS

THE POTATO SECTOR

In contrast to the developments observed in other EEC countries the potato production sector of the Netherlands has not experienced decline. The potato area has steadily increased over the last 15 years although the bulk of this increase arises from the development in the cultivation of potatoes for the starch industry. The area of ware and seed potatoes has remained relatively stable at 80-90,000 hectares since the mid-1960s although the steady increase in yield per hectare has meant that output has increased. At the end of the Second World War potato production was spread throughout the country but more recently ware and seed potato production has moved away from the sandy soils to the east of the country and concentrated more onto the clay soils in the south western provinces of South Holland, Zeeland and North Brabant and the polder soils of North East Polder and East Flevoland. Almost 85 per cent of ware or seed potatoes were grown on clay soils in 1978, compared to roughly 60 per cent at the beginning of the 1960s. The clay soils to the west of the country are very good for potato production and yields are consistently high. On the sandy soils, yields are more variable and other agricultural crops have proved more profitable for farmers. The production of potatoes for the starch industry is confined to an area of peat soils in the north east of the country around the town of Groningen, although some potatoes are taken from surrounding areas.

The structure of the potato production sector has also changed quite significantly and the average area of potatoes grown per farm has risen from 1.5 hectares in 1968 to 3.4 hectares in 1975. In 1975 there were 44,000 farms growing potatoes of which only 11,000 were classified as arable holdings. However the farmers on these 11,000 holdings grew 72 per cent of the area of potatoes in the Netherlands. These specialist potato growers, often growing potatoes very intensively, form the foundations upon which the efficient Dutch potato sector is built.

Total supplies available in 1977 were 6 million tonnes, which is an increase of 2 million tonnes on supplies at the beginning of the 1960s. In the 1977/8 season, of total available supplies of potatoes (all types), 41 per cent went to the starch industry, 14 per cent to fresh consumption on the home market, 10 per cent for processing use on the home market, 6 per cent for seed use in the Netherlands, 12 per cent for ware export, 6 per cent for export as seed and 11 per cent was unaccounted for and represents waste and utilisation as animal feed.

Occasionally, potatoes will move between the starch and ware potato sectors although in recent years these movements have been quite small, and have only occurred because of a coincidence of interest between the two sectors. The starch sector cannot be seen as a sponge to soak up surplus ware potatoes as the willingness of the starch sector to buy ware potatoes is dictated by market circumstances for starch products. Generally the potatoes used for starch manufacture are unsuitable for the ware market and the starch content of ware market potatoes is too low to be attractive to the starch industry.

In 1977 almost one-quarter of available ware potatoes (including imports) were exported in fresh form, 30 per cent were used for domestic fresh consumption and 22 per cent were utilised by manufacturers of potato

products. The remainder (a high 22 per cent because of the low prices in the 1977/8 season) represented waste, unapproved seed use and sales to the starch industry.

The consumption of potatoes per head of the population has declined in the Netherlands in a similar manner to several other West European countries. Immediately before and after the Second World War potato consumption stood at 130 kilograms per person per year but this had fallen by 1978 to stand at 83½ kilograms of which potato products represented the equivalent of 20½ kilograms of fresh potatoes.

Despite the general picture of falling consumption of potatoes in their major European markets the Dutch have managed to expand their export sales and are now the world's largest potato exporters. The vast majority of these exports go to EEC countries and in particular the West German market, although a steady trade exists outside Europe. Roughly half of their exports to West Germany go to manufacturers of potato products and this represents roughly one-quarter of the potatoes used for potato processing in West Germany.

As we have seen before, the widespread cultivation of the variety Bintje (it accounts for almost three-quarters of the ware potato area) is a very important feature of the potato sector. Its suitability for several different kinds of utilisations has introduced a powerful simplicity into the marketing system and has reinforced the position of the Dutch collecting wholesalers who perform the important sorting function. They divide the crop into different size fractions according to the requirements of the different customers. This system has allowed the potato wholesalers to reap economies of scale and has also placed them in a good position to service the emerging potato processing sector, with its requirements for continuity of supply. Whilst a major part of the storage of potatoes is carried out on the farm, some of the major wholesalers have also invested in large stores. In particular their investment has concentrated on stores which can maintain the potatoes in good condition into the summer months so that they might supply the requirements of the potato processing industry of a large part of Europe during a difficult period.

Changes have taken place in the wholesale structure as well as the production sector. With the growth of exporting, the wholesaling function has become increasingly concentrated in relatively few hands. A small number of private wholesalers and cooperatives now take a very large share of the ware crop. Increased scale of operation has been a great advantage to these wholesalers in that they can meet the requirements of large-scale buyers both on the domestic market and in other countries.

In sharp contrast to some other Member States the Dutch potato sector has operated without any form of government aid or market regulation. As a result economic forces have been 'allowed' to shape the sector and only the most efficient have survived. Also, without any institutional alleviation from price instability (as far as that is possible), all in the system have had to devise ways of coping with handling the resultant risk and uncertainty in order to survive.

THE MANUFACTURE OF POTATO PRODUCTS

Historical development

The first potato processing carried out in the Netherlands is believed to have been the manufacture of dehydrated potato products. This began soon after the Second World War on a relatively small scale and by 1960, 30,000 tonnes of potatoes were being processed by a number of small firms for whom potatoes were not necessarily the main processing activity. The quantity of potatoes being processed in the next five or six years was very variable and there was little growth in the output of the industry. One of the firms was Hollandia N.V., a subsidiary of the Swiss-based Nestlé company. In the mid-1960s this organisation began producing potato granules in a new factory built near Venray in the province of Limburg, which boosted the capacity of the Dutch potato dehydration industry and by 1974 the sector was utilising 100,000 tonnes.

The other companies continued to produce dehydrated potato pieces, either in the form of dice or strips, for incorporation into soups or for sale to other industrial users or catering outlets. Ground dehydrated potato pieces suitable for the manufacture of Klösse and Knödel are also manufactured in the Netherlands for export to West Germany. One company, Rixona, produces a dehydrated potato powder mix which is suitable for the manufacture of reconstituted french fries.

The manufacture of crisps on an industrial scale began in Holland in the late 1950s when the British firm Smiths formed a joint company with the Dutch potato wholesalers Zuiderdel in which Smiths held 51 per cent of the shares. Smiths had been manufacturing crisps in the United Kingdom since the 1920s and consequently had accumulated the technical expertise necessary to produce good quality crisps. To complement this Zuiderdel had the experience to relieve Smiths of the problems of raw material supply. By 1960 only 1,500 tonnes were being processed but the industry began to grow fairly rapidly until by 1969 more than 50,000 tonnes were being manufactured into potato crisps. By this time there had been two other entrants into this sector, first a family firm, Dam, moved into the production of french fries in 1963 and crisps in 1965 although both these enterprises finished early in the 1970s. Secondly, in 1966, Golden Wonder, a subsidiary of the diversified British cigarette manufacturers, Imperial, entered the Dutch crisp market after taking over two Dutch factories. In 1968 an American company, General Mills, bought Smiths and in 1969 they bought 25 per cent of Zuiderdel's shares thus giving them the majority shareholding in the business. In addition to these companies there have been a number of smaller organisations who have produced very small quantities of crisps. One of these organisations (Eubisfa, a subsidiary of International Telephone and Telegraph, the American multi-national) was bought by Smiths in the mid-1970s.

In addition to the crisp firms there are believed to be several companies producing potato snacks including Preservenbedrijf and Duyvis (a subsidiary of the Dutch food company, Akzo). The first extruded products were sold in the Netherlands in the early 1960s.

It is understood that the consumption of french fries was virtually unknown in the Netherlands until after the Second World War. The consumption of this form of fried potato slowly increased in popularity during the 1950s. Further to the south, in Belgium, consumption of french fries had traditionally been at much higher levels and so it is believed that the popularity of french fries spread northwards from the Dutch borders with Belgium. Initially french fries were made from fresh potatoes and

bought from small shops or vans. In the late 1950s it is understood that the owner of a number of shops selling french fries decided to centralise the peeling, cutting and first cooking, and this formed the basis of the first factory for the manufacture of french fries in the Netherlands. Over the 20 years since the establishment of the first small factory, the industry has grown very rapidly to represent an important economic sector.

Several of the larger organisations producing french fries today began production in the early 1960s. In 1962 a small number of farmers in the neighbourhood of Zutphen who were members of the local cooperative decided to establish a factory for the manufacture of french fries from their potatoes. This organisation, Aviko, soon became established as one of the largest in the Netherlands and in Europe. Other early entrants into this sector included the Van Tuyl organisation (through their factory Fritesspecialist and Dam. Originally the principal product produced was chilled french fries and it was not until the late 1960s that the first frozen french fries appeared on the market. In 1972, McCain, the Canadian potato wholesalers and processors, entered the Dutch market by buying two smaller factories and with the acquisition of another factory in 1978 represents one of the most important manufacturers in the Netherlands along with Aviko, Farm Frites and Van Tuyl.

This sector has been characterised by business failure and take-overs. In particular some of the smaller and medium-sized organisations have occasionally found themselves in very difficult financial positions, mainly because of variations in raw material and product prices. The Dam organisation, one of the pioneers of this industry, stopped production of french fries in the early 1970s and since then its principal factory has been taken over by the Van Tuyl group, and now, more recently, by McCains.

The total quantity of potatoes being processed has risen very steadily since the early 1960s from 40,000 to 602,000 tonnes respectively in 1978 (see Table N1). The most rapid rate of growth has been experienced in the french fry sector. In 1960, 6,000 tonnes of potatoes were being used for the manufacture of french fries, whereas in 1978 the figure had almost reached 450,000 tonnes. Just over 50 per cent of the output of this sector is in the form of deep-frozen products and it is this part of the industry which is experiencing the most rapid growth (see Table N2). The growth in the manufacture of chilled french fries came in the sixties and early 1970s and since then the market has stagnated. However, the growth of the entire sector continues despite a slight check during the years of 1975 and 1976 when supplies of raw material were limited because of drought conditions throughout western Europe. Table N1 also shows that the dehydrated product sector utilised 97,000 tonnes of potato in 1978, three times as much as it did at the beginning of the 1960s. However, as the table shows, the rate of growth has been very variable, mainly because demand for dehydrated potato products is related to fresh market prices. The potato snack sector shows fairly steady growth up until the early 1970s. In 1974 it reached a peak with 70,000 tonnes being processed, since then there has been a slight contraction in output and in 1978 only 63,000 tonnes of potatoes were utilised. A slow but steady growth has been experienced in the production of other products but even in 1978 these accounted for only 6,000 tonnes of potatoes.

To conclude, therefore, the Dutch potato processing industry has a comparatively short history. Indeed, all the main developments have taken

TABLE N1: Quantities of potatoes used for processing potato products ('000 tonnes)

calendar year	dehydrated products	french fries[a]	snacks (crisps, etc.)	other products	Total
1960	30,000	6,000	1,500	1,000	38,500
1961	31,000	16,000	2,500	1,000	50,500
1962	42,000	28,000	5,800	1,000	77,000
1963	18,000	32,900	10,000	1,100	62,000
1964	30,000	34,500	25,000	1,500	91,000
1965	30,000	68,500	30,000	1,500	130,000
1966	32,000	89,500	35,000	2,500	159,500
1967	52,000	91,500	42,000	2,000	188,000
1968	70,000	85,000	46,500	2,000	204,000
1969	60,000	101,000	51,000	2,500	214,500
1970	65,000	131,000	51,000	3,000	250,000
1971	73,000	156,000	56,000	5,000	290,000
1972	67,000	192,000	62,000	4,000	325,000
1973	63,000	247,000	70,000	5,000	385,000
1974	100,000	304,000	70,000	6,000	480,000
1975	107,000	324,000	63,000	6,000	500,000
1976	110,000	330,000	64,000	6,000	510,000
1977	122,000	388,000	62,000	8,000	580,000
1978	97,000	436,000	63,000	6,000	602,000

a including other fried non-snack products

Source: VAVI.

TABLE N2: Quantities of potatoes used for deep-frozen par-fried products and quantity of final product produced

Year	quantity of potatoes processed into deep-frozen products (tonnes)	quantity of deep-frozen products produced (tonnes)	per cent of potatoes processed by par-fried factories which are deep-frozen
1968	8,500	4,250	10%
1969	16,625	7,810	16%
1970	26,000	13,000	20%
1971	34,500	17,300	22%
1972	52,000	25,000	27%
1973	67,000	33,000	27%
1974	95,000	45,000	31%
1975	110,000	52,000	34%
1976	140,000	76,000	42%
1977	176,000	94,000	47%
1978	225,000	116,000	53%

Source: VAVI.

place within the last 20 years and consequently the industry is still a relatively new one. The rapid rate of growth of the french fry sector continues although its future development may be constrained by the availability of larger potatoes within the integrated potato marketing system. The dehydrated potato product and crisp sectors have reached a more mature status as the markets for these products have not continued to develop at quite the same pace.

The industry today: utilisation of potatoes, structure and location

Today, the bulk of potatoes which are processed for human consumption in the Netherlands are utilised for production of french fries and other fried non-snack products (see Table N3). In 1978, 72½ per cent of the potatoes used for processing went to factories manufacturing french fries. Although in 1978 there were 25 companies producing french fries and other par-fried products there are five companies (Aviko, McCain, Fritesspecialist, (Van Tuyl) Farm Frites and Vriezo) who produce a large proportion of the output of final product. In addition to these 25 firms there are believed to be a number of very small organisations producing fresh french fries on a very local basis. Dehydrated potato products accounted for 16 per cent of the potatoes utilised for processing in 1978 and this represents the second most important processing sector. In 1979 the industry comprised Nestlé, Rixona, and Preservenbedrijf and Top Foods Elburg. Another company, Wilco Conserven has recently stopped producing dehydrated products. Of these companies Nestlé is by far the most important and it is estimated that it produces something in the region of 60 per cent of the total output of the sector. The firms manufacturing potato crisps and snack products (Smiths, Golden Wonder, Preservenbedrijf and Duyvis) utilised 10½ per cent of the potatoes going for manufacture in 1978. Smiths is by far the largest crisp manufacturer and it is also understood to have the largest share of the rest of the potato snack market closely followed by Preservenbedrijf[1]. In addition there is a small quantity of potatoes which are utilised for the production of other products such as croquette potatoes, canned potatoes, potato pancakes and potatoes used in prepared meals. These utilised only 1 per cent of the total quantity being processed in 1978.

As can be seen in Table N4, in 1978 there were five companies using more than 25,000 tonnes of potatoes per year and these accounted for 66 per cent of potatoes utilised for manufacturing potato products. This table also indicates that the level of concentration in the industry has increased since the late 1960s and that the number of smaller companies have either ceased to exist or have been absorbed into larger companies.

1 According to Economist Intelligence Unit estimates Smiths had 60 per cent of crisp market and 40 per cent of extruded product market in 1977. Preservenbedrijf had 38 per cent of the extruded product market in the same year.

TABLE N3: Distribution of potatoes used for potato processing by product type

Product type	per cent of all potato products				
	1964	1970	1974	1977	1978
Dehydrated	33	26	21	21	16
Par-fried: fresh	38[a]	42	43	37	35
deep-frozen		11	20	30	37½
Snacks (e.g. crisps)	27	20	15	11	10½
Others[b]	2	1	1	1	1
	100	100	100	100	100

a no figures for deep-frozen products are available before 1968 or for 1978.

b includes products such as croquette potatoes, canned potatoes, potato pancakes and potato as used in pre-prepared meals.

Sources: Produktschap voor Aardappelen and VAVI.

The interests of multi-national companies in the Dutch potato processing industry are quite considerable. Among the multi-national companies are McCain Europa BV (McCain, Canada), Golden Wonder (Holland) BV (Partly owned by Imperial Foods, United Kingdom), Nestlé Nederland (Switzerland) Smiths Food Group BV (General Mills, USA) and the freezers, Lucas Aardenburg NV (Unilever, United Kingdom/Netherlands). Most of the other organisations are understood to be Dutch owned with one, Aviko being owned by a consortium of cooperatives.

The location of the major potato processing factories is shown in Map 1[1]. With a good road system linking all areas of the Netherlands, suitable quality raw material for potato processing is available throughout the Netherlands and therefore the location of the processing plants is not particularly critical. Some processors are located very close to the West German border which gives them a little more range into that country, although the advantage over factories located further to the west is marginal. Because of problems of blackspot developing after grading in Dutch Bintje from clay soils, the shorter the distance between the source of raw material and the factory the better. However, many french fry manufacturers are receiving potatoes well into West Germany without experiencing any serious problems. The decision to locate the Nestlé factory on the sandy soils of Limburg is perhaps the most obvious example of location being directly linked to the raw material requirements. This area was traditionally important for potato production but the potato sector had declined in line with the move of potato production from sand to clay soils. However, many of the farmers were skilled in potato growing and consequently it was not difficult to establish a sound source of supply by contracting with growers. In most other cases the main factor

1 See Appendix I.

TABLE N4: Companies producing potato products[a]

		potatoes processed per annum				
	year	less than 1,000 tonnes	1,000-10,000 tonnes	10,000-25,000 tonnes	more than 25,000 tonnes	total
Number of companies	1968	22	17	7	-	46
	1974	13	20	5	6	44
	1975	16	12	7	6	41
	1976	10	12	5	6	33
	1977	12	10	6	7	35
	1978	7	11	9	5	
Processed potatoes ('000 tonnes)	1968	10	60	130	-	200
	1974	6	67	92	315	480
	1975	10	45	125	320	500
	1976	4	42	84	380	510
	1977	4	41	102	433	580
	1978	2	41	160	399	
Proportion of processed potatoes (in %)	1968	5	30	65	-	100
	1974	1	14	19	66	100
	1975	2	9	25	64	100
	1976	1	8	16	75	100
	1977	1	7	17	75	100
	1978	+	7	27	66	100

a This excludes concerns which operate on an artisan-scale supplying caterers with once-fried chips.

\+ less than 0.5%

Source: Produktschap voor Aardappelen.

affecting location has been either historical accident or the availability of a suitable site at the appropriate time. Some localities of the Netherlands are faced with tighter controls of effluent disposal, and higher water costs (although these present problems for processors located throughout the Netherlands). Consequently, this has meant that these areas (usually those around the main population centres in the Randstadt) are less suitable for the location of potato processing factories.

The potato marketing system and raw material supplies

As far as raw material supply is concerned all the different sectors of the potato processing industry can be considered together. It has already been shown in Section IV that potato processors in the Netherlands are very closely interlocked into the potato marketing system, as it is largely a one-variety system based upon the multi-purpose variety Bintje.

The bulk of the raw material for manufacturing is therefore supplied by potato wholesalers and cooperatives and in particular by a small group of organisations handling a large volume of potatoes. Some manufacturers have set out to grow their own potatoes, although this represents only a relatively small proportion of their total requirements. Whilst this provides assurance of supply at predictable price it also provides some added difficulties as those potatoes which are not wanted, because they are too small or too big, have to be disposed of. It is therefore common for manufacturers who grow their own potatoes to have merchanting departments which not only buy-in raw material but also sell. Nestlé is the only company which contracts directly with producers on any scale. However, even in this case the contracting system was established with the assistance of a major wholesaler.

Wholesaling and processing operations have always been very closely linked in the Netherlands and some major wholesalers are also involved in processing. The Van Tuyl organisation is a very good example of such a vertically integrated organisation, although there are and have been other examples (the Smiths factory was originally established jointly with a private wholesaling organisation, and McCain bought an already vertically integrated merchanting/processing organisation when it entered the industry in the early 1970s). Quite naturally the approach to raw material procurement is different for wholesaler/processors and their purchases from growers must be seen in the context of their overall business operations rather than from the needs of their processing activities.

In some cases historical factors have dictated the pattern of raw material procurement, as for instance in the case of Smiths which was originally jointly owned by Smiths and Zuiderdel. The factory was sited alongside the wholesaler's potato store and consequently the two organisations (Zuiderdel is now cooperatively owned) had to work very closely together. However, this may be only very slightly different to the way in which other major processors operate for a number of very close relationships have been developed between processors and their suppliers.

One of the largest potato processors in the Netherlands is co-operatively owned (although constituted as a private company) and consequently the supply of raw material originates mainly (although not

exclusively) from members of some of the shareholding cooperatives.

The wholesalers and cooperatives which supply processors have a variety of different ways of buying potatoes from producers. Increasingly various forms of contractual arrangements have been used, some of which are based on fixed prices, some on participation prices (i.e. with the contract price being related in some way to the ware market price) and others through price pools. The latter represent participation by the growers in some of the risks of selling potatoes whilst utilising the skills of the wholesaler. Increasingly wholesalers are seeking to secure their potatoes from a core of specialist professional growers from whom they can expect to receive consistent quality potatoes and operating price pools has helped wholesalers to retain their best growers.

Because of the general availability of suitable raw material, producer groups do not have an important role to play although certain wholesalers have been instrumental in establishing groups of producers which can provide them with a guaranteed basic quantity of potatoes. However it is important to recognise that the producer groupings found in the Netherlands would never be the autonomous units, with common rules for production and marketing envisaged in the proposed Regulation for the common organisation of the potato market.

In acknowledgement of the very special requirements of the processing sector, and particularly of the important french fry sector, there have been attempts to set up a formalised set of conditions for the payment for potatoes on the basis of quality. The aim of this scheme has been to provide incentives for the production and sale of potatoes which meet the requirements of processors, although it could also have a significant effect on the quality of all potatoes if the principle was extended more widely.

The scheme is voluntary and only applicable to the french fry sector. It has two elements to cover dealings between potato producers and potato wholesalers on the one hand, and between potato wholesalers and processors on the other. The scheme to cover sales from producers to wholesalers was worked out by the wholesalers' trade association (VBNA) and the producers' Landbouwschap with some technical assistance of the Proefstation voor Ackerbouw and the potato processing institute (Instituut voor Bewaring en Verwerking van Landbouwprodukten, IBVL). The scheme lays down a standard procedure for sampling and evaluating potatoes upon delivery to wholesalers. A quality index for each consignment is obtained based on the proportion of the tubers with certain levels of damage and in particular with actual blackspot damage, glassiness and susceptibility to blackspot. All of these are particularly troublesome to Dutch processors and all can be measured objectively. Weighting factors are then applied to reflect the importance of the defect to the manufacturer and an overall quality index is arrived at. Checks on dry matter content, frying quality and peeling quality may also be made where necessary, and in addition the national quality standards for ware potatoes laid down by the Produktschap would have to be observed. Depending on the quality index a discount or premium is paid. This method has been operated by a number of wholesalers in recent years and, it appears, with some success.

The second scheme, which covers deliveries from wholesalers to processors, has been negotiated between the processors' trade association

(VAVI) and VBNA, again with the assistance of IBVL. The model conditions in this scheme are based on the same principle although the quality 'score' is based on a wider range of possible defects. Minimum quality standards are laid down and the number of potatoes which fall below these standards in a sample of 400 is counted. Depending on the defect, the number of rejected potatoes are multiplied by standard weighting factors and the resultant score determines to which of the four classes the potatoes should be allocated. For class A a premium is paid on the contract prices, class B takes the basic contract prices, class C a discount and class D is rejected.

The first of these schemes has had a limited amount of success and a number of wholesalers and cooperatives buy their potatoes on the basis of quality as measured by the scheme. However, the number of wholesalers who have adopted this system is smaller than was originally hoped. The second scheme, that between wholesalers and processors, has met with even less success and at the moment it appears not to be in use, although a number of its features have been adopted voluntarily by a number of major processors. The major stumbling block is the provision for fixed discounts or premia in the scheme. Some in the industry want to be free to negotiate these according to the availability of potatoes of that quality on the market and according to their specific needs. Without the application of the wholesaler/processor scheme there seems little likelihood that the producer/wholesaler scheme can really become established, for wholesalers who are paying a higher price for good quality raw material from producers are less likely to be able to get a similar premium when they sell to processors. However, some wholesalers maintain that because they use the producer/wholesaler scheme, their customers recognise they are quality conscious and consequently are willing to pay a premium.

All the manufacturers of french fries would be using Bintje potatoes during most of the season although some early varieties may be used during the summer months. It is fairly common for Bintje to be imported during the early part of the season when Dutch clay soil Bintje is not available. Most of these imports come from Belgium although this depends upon the price. In the crisp sector Bintje is used by the largest manufacturer although it is understood that Saturna is used by Golden Wonder. As this variety is not freely available on the ware market it has to be procured on contract, although it is understood that wholesalers would still be used as a source of supply. The dehydration sector, like the french fry sector, would use almost exclusively Bintje potatoes.

In terms of raw material the biggest problem facing the french fry sector is the availability of large sized potatoes. As the sector has grown, so has the demand for larger potatoes, and whilst this demand can be satisfied in those years when the crop produces a large proportion of larger sized potatoes this cannot always be guaranteed. In fact, in recent years there has been an increasing tendency for the price of 50 mm. plus potatoes to be at a premium to the smaller grade prices. This illustrates one of the constraints of the Dutch system, tied as it is to the one variety and with each sector dependent upon its particular fraction of the crop. The system is in balance as long as the demand for the different sizes can be equated with the distribution of different sizes within the crop. Of course it has never been possible to exactly match the requirements of the different users of potatoes with the distribution of sizes of potato within the total crop, but, in the past, the system has

been flexible enough to be able to cope. The demands of the french fry sector have been well within the limits of the output of large size potatoes. However, it now appears to be reaching the point where the supplies of 50 mm. plus potatoes cannot keep up with the continuing growth in the demand from french fry manufacturers. There is no easy solution in the reduction of the size specification because the quality of the product is badly affected and a more straightforward expedient may be to import supplies from neighbouring countries. However a more fundamental solution could lie in the discovery of new varieties which play a Bintje-type function within the marketing system but which have a much higher proportion of larger tubers. However potato breeding is a long-term and chancy business and consequently this must be a long-term objective. There are many European processors who look rather enviously towards the situation in North America where the variety Russet Burbank (called Netted Gem in Canada) provides a higher proportion of suitably sized tubers.

This problem is relevant to the consideration of the future development of the European french fry sector, for the pressure on supplies in the Netherlands will become more acute and this may act as a serious constraint on the continuing growth of the Dutch french fry sector.

External trade

In 1961, 14 per cent of all potato products were exported but by 1978 this proportion had risen to 54 per cent (see Table N5). The table also shows that the dehydrated products sector exports the highest proportion of its output, although the precise percentage exported in any given year is difficult to assess because of re-exports and exports from stores. Just over one-half of the french fry and other fried non-snack products are exported and one-third of crisps and other potato snack products. Table N6 indicates that french fries are by far the most important export both in terms of quantity and value. In 1978 they accounted for 87 per cent of all exports by volume and 66 per cent by value. Table N7 illustrates the relatively steady development of exports since the beginning of the 1960s. However, the difficulties of the dehydration sector are illustrated by the drop in exports in 1978. Also exports of snacks have shown decreases over the last 3 years.

West Germany is the most important export destination as is shown in Table N8. Of the other European countries, France, United Kingdom and Belgium are the most important markets. The table shows that the unit value of exports to Belgium is much higher than for other countries and this is because of the export to this country of crisps which have a much higher unit value.

According to Nimexe trade statistics, in recent years between one-fifth and one-quarter of dehydrated potato product exports comprise dehydrated potato pieces. The vast majority of dehydrated potato exports are sold into the West German market, although the quantity going to this destination varies considerably from year to year. In 1978 the West German market took 40 per cent of the exports of flakes and granules, although in some years it has been much higher, notably 1973 when it was 75 per cent and 1974 when it was 69 per cent. Since 1975 the United Kingdom has established itself as the second most important market for Dutch flakes and granule exports. West Germany represents the main market for other dehydrated potato products also, with this country taking between

TABLE N5: Quantity of potato products produced and proportion exported

Calendar year	dehydrated products		french fries[a]		snacks		other products		all products	
	quantity (tonnes)	exported %	quantity (tonnes)	exported %	quantity (tonnes)	exported %	quantity (tonnes)	exported %	quantity (tonnes)	exported %
1960	5,000	n.a.	3,000	n.a.	390	n.a.	300	n.a.	8,690	n.a.
1961	5,200	28	7,850	5	600	27	300	-	13,950	14
1962	7,000	27	13,800	8	1,400	24	300	-	22,500	15
1963	3,000	47	16,100	19	3,300	10	300	3	22,700	21
1964	5,000	28	16,750	36	6,200	8	350	51	28,300	28
1965	5,000	39	33,750	25	7,500	10	350	1,131[b]	46,600	32
1966	5,400	51	44,000	17	8,800	14	500	746[b]	58,700	26
1967	8,700	69	44,600	18	10,500	17	600	223[b]	64,400	26
1968	11,700	71	42,750	20	11,800	21	1,000	14	67,250	29
1969	10,000	84	50,500	26	12,700	19	1,500	27	74,700	33
1970	10,800	96	65,000	24	12,400	22	1,500	22	89,700	33
1971	11,500	96	73,300	27	14,000	23	4,000	9	102,800	33
1972	10,500	85	93,000	33	16,000	32	1,500	36	121,000	38
1973	10,000	105[b]	118,000	42	19,000	35	3,000	12	150,000	45
1974	17,000	83	145,000	46	19,000	32	3,500	33	184,500	48
1975	18,000	76	156,000	57	17,000	40	3,500	91	194,500	57
1976	18,500	113[b]	171,500	57	17,000	36	3,500	93	210,500	61
1977	20,500	85	202,000	56	16,500	36	4,500	26	243,500	56
1978	16,000	69	219,000	54	17,000	31	3,000	38	255,000	54

n.a. = not available

a including other fried non-snack products
b these figures occur because of re-exporting of imports and selling from storage.

Source: VAVI.

TABLE N6: Exports of potato products by product type

Product type	Calendar year 1974				Calendar year 1978			
	quantity (tonnes)	per cent	value ('000 Guilders)	per cent	quantity (tonnes)	per cent	value ('000 Guilders)	per cent
French fries	67,200	76	63,150	50	119,310	87	125,100	66
Dehydrated	14,130	16	37,000	30	11,110	8	36,250	19
Snacks (crisps, etc.)	6,030	7	24,030	19	5,320	4	25,900	14
Others	1,150	1	1,435	1	1,130	1	1,950	1
Total	88,510	100	125,615	100	136,870	100	189,200	100

Source: Produktschap voor Aardappelen.

TABLE N7: The exports of potato products ('000 tonnes)

year	dehydrated products	french fries	snacks (crisps, etc.)	other potato products	total	value ('000 guilders)	price (guilders/kg)
1961	1,440	390	160	-	1,990	3,013	1.51
1962	1,860	1,130	330	-	3,320	4,972	1.50
1963	1,400	3,020	330	10	4,760	5,924	1.24
1964	1,380	6,020	480	180	8,060	9,289	1.16
1965	1,950	8,420	780	3,960	15,110	16,010	1.05
1966	2,770	7,660	1,250	3,730	15,410	20,065	1.10
1967	5,980	7,810	1,830	1,340	16,960	25,316	1.49
1968	8,290	8,400	2,420	140	19,250	29,858	1.55
1969	8,460	13,210	2,410	410	24,490	34,904	1.42
1970	10,350	15,850	2,700	330	29,230	45,158	1.54
1971	11,056	19,680	3,207	370	34,313	49,820	1.45
1972	8,920	31,090	5,160	540	45,710	70,169	1.54
1973	10,750	49,750	6,740	350	67,630	101,660	1.50
1974	14,130	67,200	6,030	1,150	88,510	125,615	1.42
1975	13,640	88,290	6,720	3,180	111,830	157,735	1.41
1976	20,920	97,290	6,100	3,260	127,570	250,320	1.96
1977	17,460	113,010	5,900	1,160	137,530	238,600	1.74
1978	11,110	119,310	5,320	1,130	136,870	189,200	1.38

Source: VAVI.

TABLE N8: Destination of potato product exports

	Calendar year 1974			Calendar year 1978		
	quantity (tonnes)	%	value per kg (guilders)	quantity (tonnes)	%	value per kg (guilders)
West Germany	74,648	84	1.25	95,130	69	1.25
Belgium	3,159	4	4.05	3,794	3	4.70
Italy	2,665	3	1.92	3,059	2	1.49
France	3,769	4	1.28	17,499	13	1.22
United Kingdom	1,122	1	1.59	12,125	9	1.38
Denmark	260	+	2.35	1,203	1	1.70
Eire	10	+	3.60	1,101	1	1.07
Non EEC European countries	2,157	3	2.39	1,688	1	2.41
Non European countries	720	1	2.39	1,271	1	2.42
Total	88,510	100	1.42	136,870	100	1.38

+ = less than 0.5%

Source: Produktschap voor Aardappelen.

50 per cent and 60 per cent of the exports of the Netherlands in the years 1974 to 1978.

Although statistics are not published on the destination of crisp exports, it is well known that Belgium and Luxembourg represent the most important export destination with West Germany being of secondary importance. It is unlikely that any other countries figure as important destinations. The import statistics of West Germany indicate that roughly one-third of exports go to this country, suggesting that two-thirds go to Belgium/Luxembourg. Unfortunately there are no statistics available on the destination of french fry exports, although again West Germany will represent the most important destination, however France and the United Kingdom are also understood to be important markets as are Italy, Denmark and Ireland.

Imports of potato products are relatively insignificant, although the volume has increased steadily from 1,000 tonnes per year in the late 1960s to more than 10,000 tonnes since 1976. As can be seen in Table N9 the most consistent increase has been in french fries which come almost exclusively from the United Kingdom. The imports of dehydrated products vary considerably from year to year and were particularly high during the drought season of 1976/7. They are also believed to be high in 1979 although there

TABLE N9: The imports of potato products ('000 tonnes)

year	dehydrated products	french fries	snacks (crisps etc.)	other potato products	total	value ('000 guilders)	price (guilders/kg)
1961	598	-	-	-	598	331	5.54
1962	121	-	-	-	121	318	2.63
1963	179	-	-	-	179	259	1.45
1964	364	-	218	-	582	1,355	2.57
1965	242	7	375	1	625	1,520	2.43
1966	620	70	130	5	825	1,260	1.53
1967	365	15	30	30	440	672	1.53
1968	240	80	30	70	420	669	1.60
1969	760	220	5	95	1,080	1,342	1.24
1970	1,073	575	20	120	1,788	2,425	1.36
1971	750	575	24	27	1,376	1,874	1.36
1972	210	1,037	415	100	1,762	2,345	1.33
1973	615	4,449	20	120	5,204	5,510	1.06
1974	891	4,986	93	85	6,055	6,377	1.05
1975	1,164	4,311	583	135	6,193	8,517	1.38
1976	6,034	6,921	944	263	14,162	28,139	1.99
1977	4,071	4,864	1,907	420	11,262	23,944	2.13
1978	1,046	7,859	2,021	649	11,575	19,695	1.70

Source: VAVI.

are no statistics to confirm this. Most of the imports of dehydrated products originate from North America. The origin of crisp imports is Belgium, from where the firm Westimex/Croky Chips has established an important share of the Dutch market.

Demand

Produktschap figures indicate that the consumption of potato products has risen consistently. In 1960 it represented 1 kilogram per person per year (in raw potato equivalents) rising successively to 6 kilograms in 1965, 11½ kilograms in 1970 and 17 kilograms in 1975. In 1978 the figure was 20.5 kilograms. Unfortunately no separate consumption figures for each product group have been published in recent years by the Produktschap. The author has made some calculations of apparent consumption figures calculated on the basis of production plus imports minus exports. Such methods of calculating consumption per head are always open to some error, especially when there is the possibility that some of the output can be stores (as in the case of frozen, dehydrated and canned products). Also there is always the problem of the reliability of the import and export statistics. On the basis of these calculations it would seem that in 1978 of the total consumption of potato products, when expressed in raw potato equivalents, 82 per cent comprises french fries, 10½ per cent snacks, 4½ per cent dehydrated products and 2 per cent other products.

The demand for french fried products appears to be growing at by far the fastest rate, although it is very difficult to assess the precise rate of growth in recent years because of the effects of the two abnormal years 1975 and 1976 when supplies of raw material were very short. After steady growth during the 1960s it seems as though the demand for crisps and snacks within the Netherlands is growing more slowly, although demand appears to have slowly recovered from the big fall in consumption in 1975. It is almost impossible to comment upon the development of demand for dehydrated products in the Netherlands for it is very difficult to arrive at a figure for apparent consumption because of the possibility of storage of the product. Demand is also very variable depending upon the price of fresh potatoes and consequently it is difficult to comment upon trends. The demand for all other potato products also seems to be extremely variable and is also affected by storage in some years.

The Economist Intelligence Unit (January 1979) highlighted the following consumption patterns:

- potato products are mostly consumed by middle and younger age groups;
- virtually all french fries and other non-snack fried products consumed by households are deep frozen;
- household consumption of french fries and other non-snack fried products is confined to households with children;
- the highest consumption of potato products is in the west of the country around the large towns; to the south of the country consumers prefer to prepare fried potatoes from raw potatoes;

- dehydrated products are mostly used by families with children;

- Dutch per capita expenditure on savoury snacks is the highest of all European Community countries;

- expenditure on potato products is highest among lower and medium income groups.

There is comparatively little competition in the Dutch market for the major manufacturers of potato products. There are a number of British firms who export to the Dutch market but they represent only a very small market share and some of the imported supplies are not directly competitive as it is believed they are imported by some of the major french fry manufacturers. The crisp manufacturers experience competition from only one major foreign organisation based in Belgium. The dehydrated potato product manufacturers have suffered from the importation of North American dehydrated potato products, although in terms of the quantity produced in the Netherlands in normal years the quantities involved have not been substantial. However, this is not to play down the impact of North American competition for overall, taking into account all the Dutch markets, it has had a serious impact. Indeed, to consider the Dutch market in isolation from all other European markets provides a very narrow view of the marketing problems of Dutch manufacturers of potato products. Whilst the home market will always be important, their marketing horizons extend much further than this into most other countries of Northern Europe.

Institutional factors

In the Dutch potato marketing system there has been relatively little direct intervention of government. In the potato sector the Produktschap plays an important but generally unobtrusive role. It has the power to issue regulations concerning all the groups of people dealing with potatoes such as, for example, the national minimum quality standards for potatoes. It also plays an active part in bringing together various professions within the industry to discuss issues of common concern. For example the Produktschap were very closely involved in discussions on the establishment of a system for the payment of producers on the basis of the quality of potatoes which they supply to the manufacturers of french fries. They also have the power to take action during periods of crisis; such a period occurred during 1976 when many of the manufacturers of potato products were finding it very difficult to obtain raw material because potatoes were being exported in very large quantities due to restriction on exports from other possible exporting countries.

Another recent intervention by the Produktschap is of direct relevance to the potato processing sector. In November 1979 it passed a regulation covering quality requirements for potato flakes and granules. The regulation forbids the sale of flakes and granules unless they meet certain minimum quality standards. The main aim of introducing these standards is to limit the introduction of poor quality imported material onto the market, and it comes in the absence of the introduction of any similar standards from the Commission of the European Communities. The standards specify a maximum blue value index (an index of the free starch available) of 50, water content 10 per cent and glucose and fructose content of 3 per cent.

The standards also forbid any discoloration of the reconstituted product and any dark pieces in the dry product.

In a country where the potato industry has been largely without government intervention it came as some surprise when maximum price legislation was introduced with respect to the sale of french fries from small potato friers (chip stands). A maximum price of 80 cents per 150 grammes was established although this is understood to have had relatively little major effect on the potato processing industry as these friers take only a very small proportion of total supplies.

Whereas a number of countries put forward programmes under Regulation 355/77 which could have quite a significant impact upon their respective potato processing industries, the Dutch programme is comparatively restricted. The Dutch programme for potatoes under this Regulation is limited to obtaining assistance for the establishment of the infrastructure necessary to introduce the quality payment scheme for potatoes. In order to carry out the model contract conditions implicit in the producer/wholesaler and wholesaler/processor schemes, it is necessary for each wholesaler to have a laboratory. The programme was not extended any further because it was considered that in every other way the industry in the Netherlands was well-prepared for the future. In any case, it was considered difficult to justify obtaining FEOGA funds for the purposes of new investments given the capacity which was already available within the Netherlands. In the Dutch industry there seems a genuine concern that competition must not be distorted by the use of State, or FEOGA aids.

Two particularly important institutional factors which affect the potato processing sector of the Netherlands are the cost of water and the cost of effluent disposal. The administration of water resources is carried out by regional Waterschappen (except for coastal areas and major water-ways) which vary regulations to suit local circumstances. To all intents and purposes this disposal of effluent poses few problems in the Dutch industry except that it has to be paid for. However, that said, the costs can be extremely high in certain areas. Charges are made on the basis of the level of pollution in the effluent and the volume of water. Most of the major manufacturers have installed their own treatment plants which take out most of the pollutants from the effluent.

There are controls on the use of additives in foods and compositional standards are laid down for most foodstuffs. Sulphur dioxide is allowed up to the level of 100 ppm in potato flakes and granules and 50 ppm in other potato products (15 ppm for canned). The antioxidants BHA and BHT are allowed to a maximum of 0.01 per cent in fats and oils for frying.

* * *

To summarise, the potato processing sector of the Netherlands is closely integrated into the Dutch potato marketing system. The main feature of this system is the division of the single variety Bintje into different crop fractions for use in different markets by potato wholesalers. The combination of a relatively simple, but effective, marketing system with an efficient production sector and an innovative wholesaling

sector has proved a sound base upon which to build the Dutch potato processing industry. The french fry sector predominates and has shown itself very adaptable to the changing circumstances of the product market. However, there is some evidence that the growth of the European french fry market is outstripping the ability of the Dutch production sector to supply sufficient quantity of the appropriate raw material. Unless improved production techniques increase the proportion of larger tubers in the crop or new multi-purpose varieties are incorporated into the system this may well prove an important constraint on the continuing growth of the Dutch-based french fry industry in the future. The difficulties of obtaining enough of the appropriate raw material to meet the needs of the developing market for french fries throughout Western Europe represents a major challenge to the Dutch potato industry.

(ii) THE POTATO PROCESSING INDUSTRY OF WEST GERMANY

THE POTATO SECTOR

Following the formation of the new Federal Republic of Germany in 1949, agricultural production was intensified because of the food shortages resulting from the Second World War. Consequently the potato area increased until it reached the level of 1,190,000 hectares in 1954. Since this date, there has been a consistent reduction in the area of potatoes cultivated and by 1978 it had fallen to 356,000 hectares. No other agricultural crop in the West German farm sector has suffered quite such a decline. In the period 1950 to 1954 potatoes represented almost 15 per cent of the country's arable area, but by 1978 this had been reduced to less than 5 per cent. The reasons for this decline are the same as those encountered in many other European countries: demand for potatoes for human consumption has declined as incomes have increased; yields per hectare have increased; and a more stable return has been available to the farmer from other agricultural enterprises. But perhaps the major reason for the very substantial decline in potato production in West Germany is the reduction in the use of potatoes as animal feed. Potatoes have traditionally been fed to animals as cereal prices were maintained by protectionist agricultural policies. However, the feeding of potatoes to animals (particularly pigs) is labour intensive: and consequently the continuing reduction in the number of persons employed in agriculture has made it more difficult to accommodate potatoes as an animal feedingstuff. The potato area has contracted throughout West Germany although Bavaria has been less seriously affected.

The decline in the area of potatoes has been accompanied by a dramatic drop in the number of farm units producing potatoes. In 1966, 866,210 of all farm units with a land area of 2 hectares or more were producing potatoes but by 1974 the number had fallen to 556,000, and will have reduced substantially since. With the reduction in the number of units producing potatoes has come a shift towards a greater proportion of production being grown on larger scale units, and in 1974 farms larger than 20 hectares accounted for 45 per cent of the potato area on farms with an area of 2 hectares or more. Despite this, the average area of potatoes grown on potato farms of 2 hectares or more was still only 0.72 hectares in 1974. Holdings in southern parts of the country - Bavaria, Hesse, Rheinland-Palatinate, Saarland and Baden-Württemberg are on average smaller than in the north as a result of historical factors.

Potato production is concentrated mainly in Bavaria (38 per cent of total production) and Lower Saxony (25 per cent). Concentration of production in these two areas has increased slightly; in 1950 they accounted for 50 per cent of the national harvest compared with an estimated 63 per cent in 1978.

Improvements in yields per hectare has prevented the production of potatoes from falling as sharply as total potato area although the decline has been substantial. In 1978, total potato production was estimated at just under 10,504,000 tonnes, compared with almost 24,600,000 tonnes in 1960 and 28,000,000 tonnes in 1950.

In the 1977/78 season, of total available supplies of potatoes, 35 per cent represented early and maincrop potatoes for fresh consumption on the domestic market, 8 per cent went for processing of potato products, 7 per cent were used as seed, 5 per cent went to the starch industry, 4 per cent went for the manufacture of alcohol and 4 per cent represented stocks at the end of the season. The remainder is largely attributed to the utilisation of potatoes for animal feed, although the figure is a 'balance' after all other destinations are accounted for. The potato starch sector was developed after the end of the last World War and its importance has increased quite significantly since the early 1960s. The manufacture of alcohol has been undertaken for a much longer period under the control of the Alcohol Monopoly Laws. Whilst production increased notably between the 1960s and early 1970s the future of alcohol production for potatoes has been less certain since the relaxation of import controls on alcohol in 1976. The utilisation of potatoes for animal feed usually in a cooked form for pigs has fallen considerably during recent years. In the three seasons 1960/61-1962/63 an average of 11,500,000 tonnes was used for animal feed compared to the 4,200,000 for 1977/78. A very small proportion of waste potatoes are dried in specially built dehydration factories with the aid of subsidies under the EEC dried forage regime.

At the end of the Second World War it is estimated that the per capita consumption of potatoes exceeded 200 kilograms per person per year. By 1960/61 it had fallen to 132 kilograms and by 1977/78 had declined further to an estimated 82.8 kilograms of which potato products represented the equivalent of 21½ kilograms of fresh potatoes.

Whilst the vast majority of total available supplies comes from the domestic potato production sector, imports have become an important feature, although, to keep this in perspective, they have never represented more than 10 per cent of the supplies available from domestic sources. In 1977/78 with imports at almost 950,000 tonnes, West Germany was the world's largest potato importer. Almost a third of these imports are early potatoes from Mediterannean countries. The bulk of potato imports comprise maincrop potatoes for the fresh food processing markets, and most originate from the Netherlands although France and Belgium send small quantities. The importing of potatoes was relatively insignificant until the mid-1960s, since when it has developed with the expansion of the West German potato processing industry.

The range of varieties available on the West German domestic potato market is probably wider than in any other EEC country. In mid-1978 there were 123 varieties licensed to be grown and marketed, of which 25 per cent were early potatoes, 46 per cent second earlies and 29 per cent middle to very late. Twenty of these were classed as industrial potatoes (i.e. for the manufacture of starch or alcohol or for use as stockfeed) which could not be sold for human consumption. Very little information is available on the relative importance of the different varieties although a sample survey on the 1978/79 harvest compiled by the West German Ministry of Food, Agriculture and Forestry revealed that Grata accounted for 22.2 per cent of production, Irmgard 11.9 per cent, Hansa 8.7 per cent and Clivia 5.9 per cent. There are strong regional preferences with firm-cooking varieties being preferred in northern Germany and floury potatoes in the south.

Similar to the situation in other Member States, important changes have been taking place in the wholesale sector. In particular the number of wholesalers have been reduced and the average size in terms of throughput has increased. There has been greater pressure on the town (receiving) wholesalers because of the growth of the potato processing sector, which tends to buy its potatoes direct from collecting wholesalers, cooperatives or growers, and the growth of large retail chains which also might by-pass the services of the receiving wholesaler. However, because of the longer distances involved in moving potatoes from the production areas into the major markets of West Germany and because of the importance of imports, the receiving wholesaling function has not been diminished quite as much as in other EEC countries. From discussions with the trade it would seem that the cooperatives have gained in strength in recent years, although there are no reliable statistics to support this. Direct selling of potatoes to consumers by producers remains a very important feature of the marketing system with 31 per cent of ware potatoes being sold through this channel in 1977/78. However, contrary to trends in other countries the proportion of potatoes sold in this way appears to be in decline. Traditionally, many of the potatoes have been bought from farmers in the autumn and stored in sacks in cellars for use during the winter period. However, inadequate storage in modern flats and houses has reduced the opportunities for such purchasing behaviour.

Like the Netherlands, the West German maincrop potato sector has operated with very little government aid or market regulation. Apart from the establishment of quality standards and norms, the only official intervention has been the support of the potato drying factories and the aids made available through the Marktstrukturgesetz to improve the marketing structure of the production sector.

THE MANUFACTURE OF POTATO PRODUCTS

Historical development

Immediately following the First World War there were restrictions placed on the processing of potatoes by government decree. With the lifting of these restrictions in 1926 a number of people worked energetically to overcome the problems of producing a good quality dried potato product. Despite the efforts of these research workers, some of whom had responsibility for military catering, many difficulties were encountered, and a suitable product had still not been achieved by the end of the Second World War. Eventually Herr Werner Eckart presented a dehydrated Knödelmehl product at the first Sühoga food exhibition after currency reform in September 1949. This was the first potato product produced by Pfanni, an established canning firm, and following its successful introduction at the exhibition, the go-ahead was given for the construction of a factory at Munich and the development of further potato products. This first product was the half-and-half Knödel (comprising dehydrated raw and cooked potato) and its introduction represented the beginning of the dehydrated potato products industry in West Germany.

The manufacture of instant mashed potato in the form of potato flakes and potato granules came much later, with the first potato flakes being produced in West Germany in 1959. At this stage the Pfanni organisation had been joined in the dehydration potato products market by the Nähr-Engel

group. This organisation had been involved in potatoes for some time but began its development in the potato products market when it took over a factory at Goch in 1957. The entry of the two other major suppliers of dehydrated potato products to the West German market came in the mid-1960s. Nestlé launched their attack on the West German market from their new large Dutch factory and another Swiss based firm, Knorr, (later taken over by the US based multi-national, Corn Products Corporation) established a West German factory. Also in the mid-1960s Pfanni increased their capacity by expanding into another factory in Lower Saxony.

Shortly after the introduction of the first dehydrated potato product on the West German market, potato crisps began to be produced on an industrial scale. Early in 1951 Herr Flessner started producing potato crisps to meet the demand from the United States army camps located in Europe following the Second World War. However it was not until eight years later, in 1959, that Flessner began to make them generally available on the West German market. After a successful launch of the product the first fully automatic factory for crisps was established in 1960. The Flessner organisation was soon joined in the crisp market by other companies and these included Nabisco, Pfanni, and Pfeifer und Langen. In 1964 Flessner joined with Bahlsen a major manufacturer of cakes and biscuits, who took over the distribution of all the products produced in the Flessner crisp factories. A rationalisation of the organisation took place in the late 1960s and in 1968 and 1972 Flessner opened new factories in Bavaria and Lower Saxony. In 1972 Pfanni and Pfeifer und Langen combined to form the Funny-frisch company which later took over Chio Chips, another moderately sized organisation in the sector. Funny-frisch also bought the rights to use the brand name XOX of Nabisco when it closed down its factory in the mid-1970s. Today the industry is dominated by the two companies Funny-frisch and Flessner/Bahlsen although there are also imports, mainly from the Netherlands and France.

Although it is understood that a number of organisations had been producing french fries on an artisan scale during the 1950s, the modern french fry industry began when a potato packing and peeling firm in Essen set up a small industrial plant at the beginning of the 1960s using German machinery and Dutch potatoes. The production of the first deep-frozen french fries began a little later. Many of the organisations who entered this market on a relatively small scale have continued to sell on a very local basis. There are however a number of organisations who have expanded to produce french fries on a much larger scale. These include Schnetkamp, Stöver, Friba, Wernsing and Du-Frit.

No account of the historical development of the french fry sector can ignore the competition which has come from products manufactured in the Netherlands. Despite the fact that the bulk of the West German market is serviced by domestic manufacturers, imports of french fries from the Netherlands have taken place on a fairly substantial scale throughout the 1960s and 1970s.

The development of the processing of other kinds of potato products in West Germany is more difficult to trace. Undoubtedly canners have experimented with canned or bottled potatoes at various times, although only with the demand for convenience foods has there been any possibility of developing a steady market for such products. There is little information on the

TABLE G1: Quantities of potatoes used for processing into different categories of potato products in West Germany ('000 tonnes)

	dehydrated products	crisps etc.	deep-frozen par-fried products	(of which % french fries)	fresh par-fried products[a]	other products
1962/63	182	←			64	→
1964/65	233	←			122	→
1968	458	34	27	(n.a.)	135	11
1969	529	46	35	(n.a.)	178	24
1970	606	58	44	(81%)	193	42
1971	499	65	53	(85%)	206	54
1972	407	70	63	(84%)	262	61
1973	408	72	79	(80%)	250	79
1974	402	74	93	(86%)	221	110
1975	368	82	116	(89%)	233	77
1976	357	91	112	(84%)	217	69
1977	416	89	157	(86%)	205	63
1978	311	102	183	(n.a.)	228	70

a mainly french fries

Source: ZMP - Bilanz Kartoffeln, various issues.

TABLE G2: Output of final product of different categories of potato product in West Germany ('000 tonnes)

	dehydrated products	crisps etc.	deep-frozen products	fresh par-fried products	other products
1962/63	30	←	11	→	
1964/65	37	←	46	→	
1968	61	9	14	61	6
1969	79	12	19	80	11
1970	88	16	24	95	16
1971	72	16	29	101	31
1972	62	18	30	117	32
1973	61	19	41	113	49
1974	60	20	44	101	61
1975	54	22	53	106	43
1976	52	25	51	98	37
1977	61	24	71	93	35
1978	46	28	83	104	39

a mainly french fries

Source: ZMP - Bilanz Kartoffeln, various issues.

development of the manufacture of other potato products. Many of these products are produced by organisations involved in manufacturing one of the three main groups of potato products. In particular the manufacture of potato salad is quite commonly associated with the manufacture of french fries as this product can be made with potatoes which are not suitable for producing good quality french fries.

The data of the Bundesverband der Kartoffelverarbeitenden Industrie (BKI) indicate that the total quantity of potatoes being processed rose rapidly during the 1960s from 186,000 tonnes in 1960 to 942,000 tonnes in 1970 and over the same period the output of product increased from 31,000 tonnes to 238,000 tonnes (see Tables G1 and G2). Since that date, the total quantity of potatoes manufactured has not increased so rapidly, mainly because of a reduction in the utilisation of potatoes for the manufacture of dehydrated potato products. However the effects of this on the overall quantity of potatoes processed by the potato processing sector has been offset by the increasing demands of the still expanding frozen french fry sector. As can be seen in Table G1 the dehydrated potato products sector experienced very rapid growth up until 1970 when more than 600,000 tonnes were processed. Since that date the quantity of potatoes used has fallen although it must be added that evidence of a decline is not supported by the data from the West German Statistical Office as reported in Kartoffelwirtschaft[1]. Variations in demand for dehydrated potato products because of changes in the fresh potato price make it difficult to confirm a real decline in the sector, although, according to the BKI data, the total quantity of potatoes utilised in 1978 (311,000 tonnes) is almost 300,000 tonnes less than was being used in 1970.

The pattern of development of the french fry sector since the early 1960s has shown a rapid and consistent increase in the output of deep-frozen french fries, but a less consistent development of the fresh or chilled product (see Tables G1 and G2). The real growth in the output of fresh french fries came in the period which included the 1960s and the early 1970s and at its peak in 1972 was utilising 262,000 tonnes of potatoes. In 1978 the quantity of potatoes utilised had fallen to 228,000 tonnes (a slight recovery on the previous two years). In contrast, the growth of the deep-frozen french fries sector continues and in 1978, 183,000 tonnes of potatoes were being manufactured into deep-frozen fried products. The crisp and snack sector utilised 102,000 tonnes of potatoes in 1978 which was a significant increase on the quantity used in the previous year. Up until 1977 the quantity of potatoes used had increased consistently from year to year although it still remains fairly modest in comparison with the development of the United Kingdom industry. After a period of consistent growth from the mid-1960s to mid-1970s the quantity of potatoes required for the manufacture of other potato products declined up to 1977. However in 1978, 70,000 tonnes were used for the manufacture of

---

1 There is a lack of agreement on a number of accounts between those data on the potato processing sector provided by the Bundesverband der Kartoffelverarbeitenden Industrie (BKI), (the potato processors' trade association), and those of the West German Statistical Office. The BKI statistics are quoted in this report as they appear to be more generally accepted.

products such as canned or bottled potatoes, potato salad and other miscellaneous potato products, an increase on the 1977 figure.

To summarise, the historical development of the potato products sector of West Germany has been characterised since the Second World War by three distinct phases. During the 1950s all the growth in the sector came through the development of dehydrated potato products. The sixties was a period of substantial growth by each of the main groups of products. By the early 1970s the pattern of consistent growth had been slightly amended in that the output of dehydrated potato products and fresh french fries were no longer continually increasing. However, during the 1970s the output of frozen french fries and crisps has continued to increase, the former at a very rapid rate.

The industry today: utilisation of potatoes, structure and location

Following the decline of recent years, in 1978, for the first time, the dehydrated potato sector was not the most important user of potatoes within the potato products industry of West Germany. In 1978, 34½ per cent of the potatoes destined for potato processing went to this sector. There are three major companies which take the vast bulk of potatoes used for making dehydrated products. They are Pfanni-Werk, Otto Eckhart KG, Nähr Engel GmbH and CH Knorr GmbH. Four other organisations, Knoll, Brückner-Werke KG, Fokken and Azet-Werk, also manufacture dehydrated products but on a much smaller scale. Now the most important user of potatoes is the french fry sector. In 1978, 45½ per cent of potatoes manufactured into potato products were utilised by companies manufacturing french fries. Slightly less than half of these were being utilised for manufacturing deep-frozen fried potato products. From trade sources it is estimated that there are approximately 40 manufacturers of french fries of which 12 are involved in producing frozen products. Schnetkamp, Stöver, Friba, Wernsing and Du-Frit are believed to be the largest manufacturers on the West German market. Of these, Schnetkamp is believed to be the largest single manufacturer.

The potato crisps sector accounted for 11½ per cent of the potatoes processed in 1978. There are only two major organisations still manufacturing crisps, namely Funny-frisch and Flessner/Bahlsen. The latter organisation is believed to have utilised a slightly larger quantity of potatoes, although the market shares of the two organisations are not very different. Both of the two major crisp manufacturers are also involved in the manufacture of snack products, some of which include potato flakes or potato granules. The range of these products is increasing and they are growing in importance in the snack market although they have not reached the level of penetration achieved in the United Kingdom. Both of the major companies produce a crisp which is made from potato flakes or granules; the Bahlsen product selling under the brand name of Chipsletten and the Funny-frisch product selling as Crackets. Flessner are involved with four other European snack firms in the production of this product and have set up a separate snack production company (Snacks Produktionsgesellschaft) in conjunction with De Danske Spritfabrikker (Denmark), Flodor (France) and Nutricia (the Netherlands). Eight per cent of the potatoes used for processing were used in 1978 to manufacture products other than crisps, french fries and dehydrated products. Little is known about the importance of different products within this sector although it is understood that canners

(8)

and bottlers and firms producing potato salad represent a major part of the output. It is understood that there are five major organisations involved in the manufacture of bottled potatoes. These organisations are Konservenfabrik Wendeburg, Ebbrecht-Konserven, Raiffeisen-Hauptgenossenschaft, Hennecke Konservenfabrik and Warburger Nahrungsmittelwerke.

The ownership of West German potato processing organisations by companies located outside West Germany is not common. In the dehydration sector Knorr are owned by the North American multi-national Corn Products Corporation and in the french fry sector the United States based Cargill company holds an interest in the Du-Frit organisation. It is interesting to note that many of the larger organisations which were formed in the earliest days of the potato products industry of West Germany are still owned mainly by the founders or by their families.

The location of the factories producing potato products is shown on Map 2[1] although some smaller factories producing french fries may not be included. It will be recalled that the main concentrations of potatoes occur in the regions of Bavaria and Lower Saxony. Potato processing plants are located throughout West Germany although it is possible to identify a number of concentrations. Firstly a number of manufacturers have been established in and around the major Rhine-Ruhr and Rhine-Main conurbations. This particularly applies to many of the manufacturers of chilled french fries for whom a location in close proximity to the market provides the opportunity of greater flexibility in servicing customers with a product with a relatively short shelf life. For french fry manufacturers being located in the west of the country also means that they are within easy access of Dutch Bintje potatoes although the manufacturers of other products have also taken advantage of this. Some manufacturers of french fries have chosen to locate in the major potato production areas and particularly those areas where it is possible to grow Bintje potatoes. There is an area south and west of Bremen which can grow very good quality Bintje potatoes and it is here that some of the largest french fry manufacturers in West Germany are located. In addition smaller scale manufacturers of fresh or chilled french fries are located throughout the country to meet local demand.

In the crisp sector access to Bintje potatoes, whether grown domestically or in the Netherlands, is not important because the variety Saturna is preferred. More important is the identification of sources of local supplies over which control of quality can be maintained. In solving their locational problems the two major crisp manufacturers have taken different decisions. Originally the Flessner factory was located very close to Frankfurt. In the early 1960s with the expansion of the company, production began in central Bavaria and in the west of Lower Saxony. Later in the 1960s the central Bavarian factory was closed down and a new factory was erected further east, almost on the border with Czechoslovakia. Four years later another factory was established in the east of Lower Saxony on the border with East Germany. Now the manufacture of crisps and sticks is carried out exclusively in these two newer plants and the plant to the west of Lower Saxony is used for the manufacture of other snack products. These are now the only Flessner factories which produce potato products. The location of the two factories using fresh potatoes as raw material is interesting. Both the locations are in areas which border Eastern Europe

---

1 See Appendix I.

and consequently special aids would have been available to assist the establishment of the factories. Just as important however, was the possibility of establishing a source of raw material from around the factory sites and this was done by the establishment of producer groups among producers whose future in growing the potato crop may well have been threatened if factories had not come into existence. The precise nature of raw material procurement will be commented upon a little later.

The other major potato snack organisation, Funny-frisch, has three factories, two of which produce potato crisps and sticks and the other snack products. One of the factories using fresh potatoes as raw material is located in the heart of the Rhine-Ruhr near Köln and the other is located further south in the Rhineland-Palatinate. The plant manufacturing snack products is located in the west of Lower Saxony on the same site as the Pfanni (one of the joint owners of Funny-frisch) dehydration plant in that area (from which the potato flake for manufacturing snacks would be obtained). Both of the factories using fresh potatoes as raw material purchase supplies from the Netherlands, although most potatoes come from local West German sources. The main reasons influencing location are historical, with the Köln factory being located on the site of the sugar refinery of one of the joint owners and the more southern of the two factories being acquired by takeover.

In the dehydration sector the largest manufacturer, Pfanni, originated in the Munich area and its principal factory is still located in the middle of the city. It draws its potatoes from the important Bavarian potato production area. In 1966 Pfanni opened a plant in another major production area, in western Lower Saxony, again to draw upon the ample local supplies. The Knorr factory like the two Flessner factories is located on the border area with East Europe and border assistance would have been a powerful factor influencing location. The factory is located in the east of Lower Saxony, on the border with East Germany. The Nähr-Engel plant is located at the other end of the country in North Rhine Westphalia, in fact right on the border with the Netherlands, and is the only major dehydrator to base its production mainly on imported supplies. Nähr-Engel inherited this location when it purchased the factory of an organisation which had gone into liquidation.

Most of the canning factories which are processing potatoes are located in the north of the country which means that they have easy access to the firm cooking variety Hansa which is almost exclusively used for bottling. The major factor influencing the location of all these plants is the availability of supplies of the other fruit and vegetables which are being canned.

The potato marketing system and raw material supplies

In order to obtain the necessary raw material for processing, the potato product manufacturer has a number of possible alternatives. The organisation can grow potatoes itself, take advantage of existing wholesaler or cooperative channels, or buy directly from producers, either dealing with them individually or buying from groups of producers. In West Germany the potatoes which are available on the ware market are not generally suitable for the manufacture of potato products and consequently, in order to obtain suitable quality potatoes, supply mechanisms have had to

be set up which are specific to the processing sector. This does not necessarily mean that wholesalers or cooperatives, the traditional assemblers of potatoes are not involved in supplying potato processors, but, if they are involved, separate supply channels, usually involving contracts, have to be set up in order to obtain the appropriate variety and quality. As was indicated in Section IV of this report the choice of procurement method depends on a wide number of factors, of which the type of product being produced and the location of the factory are very important.

The two crisp manufacturers have set out to establish direct contracts with potato growers with the minimum involvement of potato wholesalers and cooperatives. In particular, the Flessner organisation has taken over a very large part of the responsibility for the production of the necessary raw material in close cooperation with a number of producer groups which have been formed around its major crisp factories. The aim has been to have as much control as possible over the growing, harvesting and storing of potatoes so that suitable quality can be assured.

The encouragement of producer groups in West German agriculture has played an important part in all sections of the potato processing sector. In order to promote the establishment of producer groups in various sectors of German agriculture the Marktstrukturgesetz was passed in May 1969. The law was passed in recognition that West German agriculture would have to adapt to the increasingly competitive circumstances within the EEC. It was also passed in recognition that the market position and bargaining power of the many small-scale agricultural producers would inevitably weaken as large-scale buyers, such as processors and large-scale traders, became prominent in the marketing system. The law lays down certain conditions under which producers can join together to form a producer group and qualify for aids. Producer groups may deal with only one product so that the problem of conflicting interests within a group is minimised. Aids are available for the establishment of producer groups and assistance can also be obtained for any initial investments that the producer group might make. In addition, the Marktstrukturgesetz enables investment aid to be payable to any market partner who agrees a supply contract with a producer group providing these contracts meet certain criteria and involve minimum quantities and a minimum duration. The incentives available through the Marktstrukturgesetz have had quite an impact on the procurement of potatoes by potato processors and it has been estimated in a survey published by the German Farmers' Union that in 1976, 17 per cent of supplies going to the potato processing industry is now organised through producer groups operating independently or within the framework of cooperatives (the report suggests that if imported supplies are excluded the figures is 23 per cent).

The Flessner procurement system provides a very good example of the Marktstrukturgesetz working as it was originally intended. The company is able to exercise greater control over the quality of raw material because it can communicate to farmers through the agency of the producer group. The company feels that closer cooperation with farmers through producer groups can only result in a better understanding of the company's problems on the part of the producers and a better appreciation of producers' difficulties on the part of the company.

Among the manufacturers of dehydrated potato products Pfanni and Knorr make greater use of the traditional assemblers of potatoes, particularly the cooperatives but also the collecting wholesalers. There appears to be a preference for cooperatives, for the same reasons that producer groups are attractive, although the need for tight control over quality is less critical than for crisp manufacture. In fact where cooperatives are involved it is quite common for them to form separate producer groups within their membership framework so that those within the producer group can concentrate on supplying the raw material needed for processing. In these circumstances those members of the cooperatives who are involved in the producer groups will be producing potatoes on the basis of fixed price contracts rather than taking the market price which other members of the cooperative have to accept.

The involvement of cooperatives rather than the establishment of their own independent producer groups reflects the fact that the manufacturers of dehydrated potato products are buying larger quantities of potatoes than the crisp manufacturers and consequently the administrative problem of organising procurement directly from growers is that much greater, especially in those areas where the structure of agricultural production is more fragmented. Nähr-Engel is in a different situation because the factory is located on the Dutch border where Dutch Bintje is readily available. Consequently like many of the french fry manufacturers in similar locations, Dutch potato wholesalers and cooperatives are the principal sources of raw material.

The manufacturers of french fries should perhaps be considered separately in terms of their raw material procurement policy. These manufacturers prefer the variety Bintje and although other varieties are utilised, it accounts for the bulk of the industry's requirements. A number of french fry manufacturers have set out to procure their raw materials from domestic sources and the Marktstrukturgesetz provided an opportunity for the industry to develop these. Producer groups have been set up to supply Bintje potatoes and some manufacturers obtain a significant proportion of their raw material from these sources. The Stöver organisation provides a good example of a potato manufacturing organisation which is very closely integrated with a producer group, although it should be pointed out that the situation of this company is unique as Herr Stöver was originally a farmer and consequently the business has expanded from a farming base. The producer group which works with the Stöver french fry factory has facilities alongside the factory site for the storing and grading of potatoes. The company provides producers in the group with specialist advice on the husbandry practices necessary to produce good quality potatoes. The company is also involved in the supply of seed to the producer groups and it can also assist in providing various services for the members on a contractual basis. A fixed price contract is paid for those potatoes which are suitable for french fries and the producer group sells the other potatoes on the ware market. Not all manufacturers operate quite so closely with their producer groups as this, although a good deal of cooperation is necessary if the system is to operate efficiently. A major problem for producer groups which supply the french fry industry is disposing of those potatoes which are not wanted by the manufacturers (this can involve a fairly large proportion of the crop). Some producer groups have got over this by establishing pre-packing facilities. Inevitably, producer groups who work with french fry manufacturers have to be prepared to establish rather more sophisticated organisations than is required to supply

the crisp or dehydration sectors if they are to economically dispose of all their crop.

Despite the aids which are available through the Marktstrukturgesetz and the advantages of integrating a group of producers into the business, the success of producer groups in the french fry sector can best be described as patchy. This has not arisen because of defects in the idea of producer groups but more because of the problems of obtaining a potato which is of suitable quality for the french fry sector from West German soils. Consequently, a large proportion of the supplies of raw material for the french fry sector are still purchased from the Netherlands, indeed there is some evidence that some manufacturers are returning to Dutch suppliers after experimenting with supplies obtained through producer groups.

In particular the manufacturers of french fries are impressed by the consistent quality of Dutch Bintje and it is this feature more than anything else which has maintained the dependence of the french fry sector on Dutch Bintje potatoes. There has been every incentive for the West German potato production sector to substitute Dutch supplies but their efforts have only met with limited success. Bintje is only grown on any scale in two relatively small areas of West Germany, to the south and west of Bremen and around Braunschweig. It is from these areas of good quality soils that major producers, like Schnetkamp and Stöver obtain their German supplies. Attempts to grow the variety elsewhere have not met with great success, mainly because the quality tends to be variable from year to year. There have also been attempts to breed new varieties which are suitable for the french fry sector. Tests by the National Potato Processing Institute (BGK) at Detmold have indicated that there are a number of new varieties which seem to perform better than Bintje in a number of comparative tests. However, it remains to be seen what enthusiasm West German processors will have for new varieties when they have available from Holland a consistent quality potato which has proved itself over the long-term.

It has already been noted that the importation of potatoes for processing is an important feature of the raw material supply for the West German potato processing industry. Table G3 shows the quantity of potatoes imported into West Germany for the purposes of processing. The quantity increased through the 1960s with the growth of the french fries industry and by the 1970s approximately 250,000 tonnes were being imported each season. As can be seen in the table, this has represented between one-quarter and one third of the total quantity of potatoes processed in West Germany. The vast majority of these imports originate from the Netherlands (between 86 and 98 per cent in the years since 1972).

Although most of these imports have been destined for the french fry industry some major crisp and dehydration firms located close to the Dutch border have also looked towards the Netherlands for their raw material supply. After account is taken of purchases by crisp and dehydration factories it is estimated that roughly one-half of the raw material requirements of the french fry sector is accounted for by raw material purchased from the Netherlands. Despite the absence of growth in the quantity of raw material imported during the 1970s there is little evidence from discussions with processors that their enthusiasm for Dutch Bintje is on the wane. Most of the french fry manufacturers and particularly those

TABLE G3: Imports of potatoes for processing into West Germany, 1966/67-1977/78

	tonnes	percentage of total quantity processed[a]
1966/67	146,000	29
1970/71	243,000	26
1971/72	261,000	30
1972/73	237,000	28
1973/74	284,000	32
1974/75	221,000	25
1975/76	214,000	24
1976/77	243,000	29
1977/78	263,000	28
1978/79	267,000	30

a These percentages are based on calendar year production figures and therefore may provide a slightly misleading indication of the situation in any given year.

Source: ZMP - Bilanz Kartoffeln, various issues.

involved in the more rapidly growing deep-frozen sector remain convinced that Dutch imports best meet their requirements.

The position of Dutch suppliers of potatoes in the West German market is strengthened by their experience in meeting the requirements of potato processors over a fairly long period. Many processors seem quite content to rely upon Dutch suppliers and the quality of their service is often commended. However, among some processors there appears to be a strong desire to become independent of the Dutch especially in those areas of the country where comparable Bintje potatoes can be produced. It seems natural to expect that some German manufacturers will feel uneasy at receiving supplies from some Dutch wholesalers who also have very significant interests in producing french fries. However, no one could provide direct evidence of their competitive position being undermined in such a situation.

The potatoes which are supplied to processors in West Germany are usually covered by delivery conditions laid down in a national agreement between businesses trading in potatoes. This agreement, called the Berliner Agreement, covers such areas as the drawing up of contracts, and storage and delivery requirements. Alternatively, especially if the processor is purchasing imported supplies, the RUCIP rules of trade in potatoes will be adopted. In addition to this it is quite common for manufacturers to establish their own contracts which reflect their own specific requirements and this is the most frequent procedure when purchasing potatoes from individual producers. Not all potatoes will be bought on the basis of contracts agreed in advance of harvest for most manufacturers will wish to retain at least some flexibility in their operations by buying potatoes from the ware market. This does put them at some risk in that it may be difficult to find the appropriate quality potatoes on the ware market but the alternative is to expose themselves to the risk of being over-committed to raw material in a market which is notoriously unstable. All ware market purchases will be from cooperatives or collecting wholesalers and either Berliner Agreement or RUCIP conditions will apply.

External trade

Potato products imported from other countries supplement the production from West German factories. However, it is very difficult to quantify the precise scale of imports into West Germany because of inadequate trade statistics. The major problem is that the different potato product groups are not recorded under separate headings in the trade statistics, although there is also a suspicion that certain imports are not recorded consistently in those categories which are available. The only major product group which one can talk about satisfactorily is dehydrated potato products, as fairly clear-cut categories have existed for these products; although for some time even with that category there is some suspicion that confusion could arise with respect to treatment of imports of dehydrated products destined for animal feed. The situation has been improved since 1975 as the external trade in potato crisps and sticks and frozen french fries have each been recorded separately.

From Table G4 it can be seen that there has been a fairly steady increase in the imports of dehydrated potato products, and particularly flakes and granules since the mid-1960s. As can be seen in Table G5 the Netherlands has been the principal source of these imported dehydrated potato products. However, during 1976 and 1977 there were insufficient

TABLE G4: Imports of dehydrated potato products into West Germany ('000 tonnes)

year	dried potato pieces	granules and flakes	year	dried potato pieces	granules and flakes
1962/63	0.7	1.0	1970/71	3.4	4.8
1963/64	0.1	0.9	1971/72	4.0	5.1
1964/65	0.2	0.5	1972/73	2.8[a]	5.1
1965/66	0.5	3.6	1973/74	1.9[a]	7.3
1966/67	2.0	0.5	1974/75	2.2[a]	7.6
1967/68	3.1	1.1	1975/76	1.2[a]	10.5
1968/69	3.6	1.8	1976/77	4.9[a]	27.6
1969/70	3.4	3.4	1977/78	n.a.	6.4

a Calendar year data taken from Nimexe tables and "Kartoffelwirtschaft", Vol.28, No.20, p.2.

Source: ZMP - Bilanz Kartoffeln, various issues.

TABLE G5: The source of imports of dehydrated potato products into West Germany

	flakes and granules				dehydrated potato pieces	
	Netherlands	France	US	Poland	Netherlands	US
1974	84%	10%	-	6%	91%	-
1975	82%	14%	-	4%	86%	-
1976	34%	4%	60%	-	30%	66%
1977	32%	5%	62%	-	27%	66%
1978	56%	16%	24%	-	57%	35%

Source: NIMEXE.

supplies available from the Netherlands and substantial quantities were imported from the United States. The United States has continued to export flakes and granules to West Germany in 1978 although in that year the demand for imports had dropped quite significantly because of the availability of products imported in 1976 and 1977 from stores.

Table G6 indicates that imports of potato products other than dehydrated has increased quite substantially during the 1970s. The expansion of the exports of french fries from the Netherlands to West Germany account for the greater part of this expansion although the trade statistics do not allow for full clarification of the situation. The newly collected trade statistics on potato crisps suggest that approximately 3,000 tonnes are imported into West Germany each year mainly from the Netherlands and France. This suggests that the imports of crisps comprise just over 10 per cent of the West German market for these products, although trade sources in West Germany indicate that this might be an underestimate. Prior to 1970 it is believed that the imports of crisps were relatively insignificant. It has already been noted that the two West German manufacturers pay a lot of attention to quality and in particular produce a very light coloured crisp using the Saturna variety. Some of the importers manufacture crisps from Bintje potatoes and consequently their colour is often darker. The German manufacturers have maintained their quality image, but at least one produces separate brands which allow them to compete with lower quality imports without prejudicing their position at the quality end of the market.

There is substantial competition on the West German market from french fries and other fried non-snack products manufactured in the Netherlands. Imports of Dutch manufactured french fries has taken place throughout the 1960s and 1970s although it is difficult to be able to chart their penetration of the West German market because of inadequate trade statistics. However, it is estimated that Dutch manufactured products represent something like 35 per cent of the West German market for french fries and other fried non-snack products. Imported supplies take up roughly 15 per cent of the fast growing deep-frozen segment of this market. The imports of frozen french fries appear to be expanding rapidly, although a note of

TABLE G6: Imports of potato products, other than dehydrated, into West Germany ('000 tonnes)

	all products other than dehydrated	- of which:	(crisps)	(frozen french fries)
1971	15.7		n.a.	n.a.
1972	26.9		n.a.	n.a.
1973	41.9		n.a.	n.a.
1974	52.1		n.a.	n.a.
1975	65.1		(4.2)	(3.2)
1976	73.2		(2.7)	(11.4)
1977	82.0		(2.6)	(10.4)
1978	79.1		(2.4)	(13.0)

n.a. = not available

Source: Statistiches Bundesamt.

caution must be added because the level of imports as shown in the trade statistics seems fairly small in relation to the output of frozen products in the Netherlands.

West Germany exports only a very modest quantity of potato products of which dehydrated potato products and potato crisps are the most important (see Table G7). The principal market for dehydrated potato pieces is the United Kingdom and the main market for flakes and granules is Italy, although a number of other countries takes small quantities. The principal export market for crisps is Italy although small quantities are also sold into Belgium/Luxembourg, France and the Netherlands.

Demand

It has been calculated that in 1978/79 the consumption of potato products when expressed as fresh potato equivalents was 23 kilograms per person per year. The level of consumption per person per year increased steadily from the mid-1950s to the beginning of the 1970s despite the variability in demand for dehydrated products according to the price of fresh potatoes. Since then there has been some levelling off in consumption mainly because of the falling demand for certain dehydrated potato products. Unfortunately because of the absence of suitable trade statistics it is not possible to calculate the precise level of consumption prior to 1973/74, although it is known that consumption of products manufactured in West Germany increased steadily up until the 1970s. The years 1975/76 and 1976/77, when fresh potato prices were high provided a shot in the arm for the consumption of potato products. In those years consumption increased dramatically and not all the increases were lost when fresh potato prices returned to more 'normal' levels in 1977/78 and 1978/79. Table G8 shows the development in consumption since 1973/74.

TABLE G7: The exports of potato products from West Germany ('000 tonnes)

	dehydrated potato pieces	flakes and granules	other potato products - of which:	(crisps)	(frozen french fries)
1970	0.7	2.2	n.a.	n.a.	n.a.
1971	0.3	3.0	0.9	n.a.	n.a.
1972	0.5	2.5	1.0	n.a.	n.a.
1973	0.9	3.8	2.3	n.a.	n.a.
1974	1.1	9.0	1.4	n.a.	n.a.
1975	1.0	6.1	1.0	(1.6)	(1.8)
1976	1.0	4.4	2.1	(1.1)	(0.8)
1977	1.1	2.2	2.8	(0.9)	(0.7)
1978	1.1	1.6	2.2	(1.4)	(0.8)

n.a. = not available

Source: Statistiches Bundesamt.

Institutional factors

There have been attempts within West Germany to improve the quality of potato products which come on to the market. Quality guidelines (Richtlinien) are laid down for french fries, potato crisps and sticks, fried potato pieces, potato Klossmehl and potato flakes or granules. These quality guidelines are drawn up by the Bund für Lebensmittelrecht und Lebensmittelkunde e.V. (BLL) and were published in 1975. The guidelines also lay down the methods by which quality shall be measured. These quality guidelines do not appear to be particularly tough or detailed and as a result it appears that they give no real concern to the potato product manufacturers of West Germany.

In an attempt to meet competition from Dutch imports of french fries the Central Marketinggesellschaft der deutschen Agrarwirtschaft (CMA) (an industry-supported market development agency) has extended its national quality mark scheme to this product group. Manufacturers can use the CMA quality mark if their products meet the guidelines laid down by the BLL and if they meet certain additional quality criteria established by CMA covering colour, consistency, taste etc. Some problems have been encountered in establishing the Scheme. This may reflect the problems which individual manufacturers might have in meeting the minimum standards or it may simply suggest that manufacturers see no great advantage in the Scheme and feel that the interests of the industry would be better served by relying on the entrepreneurial abilities of each individual manufacturer. The CMA intend to extend the Scheme to other types of potato products.

In West Germany there is also a regulation which lays down permitted maximum levels of incorporation of sulphur dioxide. In dried and frozen potato products sulphur dioxide is permitted to a maximum of 100 parts per million with declaration, and on all other potato products 50 parts per million without declaration. In addition the incorporation of other additives is controlled by new legislation which came into force on 1st January 1978. Within this legislation all the permitted uses of additives are given in one regulation 'Zusatzstoff-Zulassungsverordnung' (the additives permissibility regulation) of December 20th, 1977. This regulation indicates a number of additives which may be incorporated without restriction and without declaration providing the compositional regulations on a particular foodstuff do not prohibit the addition of any substance to that foodstuff. In addition there are lists of permitted colours, antioxidants and preservatives which show all the foodstuffs in which these substances may be used and there is a list giving details of permitted applications, levels of use and labelling declarations for all other food additives. For example dehydrated potato products based on cooked potato, ready to eat dehydrated potato products, and deep-frozen par-fried potato products can only contain 0.01 per cent of the synthetic antioxidant BHA. If it is used then it must be declared as an 'antioxidant'; BHT is not allowed.

As has been said before, the West German government has operated without any institutional regulation of the potato market. However, there have been a number of regional potato plans operating within the two major producing Länder, Lower Saxony and Bavaria. These regional plans, which have attempted to review the progress and development of the potato

industry have recently been adapted to form the basis of the submissions of programmes under EEC Regulation 355/77 on "common measures to improve the conditions under which agricultural products are processed and marketed". The original plans were introduced as additional support for the Marktstrukturgesetz and the new plans proposed as part of Regulation 355/77 also promote the producer group idea in Lower Saxony. Although the Lower Saxony programme aims to expand efficient storage and sorting facilities this provision is not directly aimed at the potato processing sector.

In common with several other EEC countries, the potato manufacturers are faced with the problem of disposing of the waste from potato processing factories and the cost of water. To overcome the pollution problem quite substantial sums of money have had to be invested in water purification schemes as the cost of discharging effluent can be very high. There are also tight controls on hygiene within factories producing food products and some of the manufacturers consider that these requirements along with the tighter pollution controls and high water costs could put greater pressure on smaller organisations, especially those many small organisations involved in producing french fries. Market factors are also putting greater pressure on these smaller organisations as deep-frozen products seem to have greater growth potential. These factors will work towards producing a more concentrated processing sector in the future although to a certain extent this may be resisted by smaller organisations by much greater flexibility of operation.

* * *

It is very difficult to generalise about the large West German potato processing industry because of its regional dispersion, wide range of products and the many different sizes of organisations operating in the industry. There are several factors which serve as important challenges to the industry, namely the problem of consistently obtaining suitable quality raw material for the french fry sector, the proximity and strength of competition from the Netherlands, and the contracting demand for dehydrated potato products. In addition it must be acknowledged that West Germany looks rather uneasily towards the East as competition from East European countries could become an important long-term consideration. The problems of raw material procurement differ considerably between locations. A particularly strong feature of the industry has been the close relationships which have developed between processors and producers (usually organised in producer groups). The producer group concepts seem particularly well adapted to the circumstances of some West German processors, especially those located in areas where suitable quality raw material has not been easily available. The domestic markets for crisps and french fries continue to expand and thereby offer substantial opportunities to both these sectors of the West German potato processing industry.

(iii) THE POTATO PROCESSING INDUSTRY OF FRANCE

THE POTATO SECTOR

A note of caution must be entered on the quality of the statistical information which describes the historical development of the potato sector of France. These statistical inadequacies reflect a major problem of the sector namely the very fragmented structure of the industry. Most historical accounts agree that the spread of the cultivation of the potato into France was relatively slow until after the years of the Revolution and the Empire wars. The potato area reached a peak at the beginning of the 20th century when it was believed to have been in excess of 1,500,000 hectares and production was around 13 million tonnes. At the end of the Second World War the area of potatoes in France just exceeded 1 million hectares but by 1977 it had fallen below 300,000 hectares. The reasons for this decline are the same as those which have brought about the decline in the area of potatoes cultivated throughout most of Europe. Almost 80 per cent of the area of potatoes grown in France comprises varieties which can be classified as maincrop (230,000 hectares) and the reduction in the area of these potatoes accounts for the bulk of the contraction of the area, although the area of seed potatoes (14,600 hectares), potatoes for the starch industry (12,500 hectares) and early potatoes (33,000 hectares) have all contracted significantly since the last World War.

Maincrop potatoes are grown throughout France although their production is increasingly being concentrated in the northern regions of Picardie and Nord. However, even in 1978 these two major regions only accounted for 29 per cent of total maincrop area. The other important area for maincrop potatoes is Brittany which accounts for another 11 per cent. Early potatoes are also grown all over France but there is a strong concentration in Brittany which accounts for almost one-third of the production of early potatoes. Another important area for early potatoes occurs in the South of France, particularly the region of Provence. The seed potato industry is concentrated mainly in Brittany and in 1976 this region accounted for 62 per cent of the total area of seed potatoes cultivated.

It is not known precisely how many producers are involved in cultivating potatoes. At the last census in 1970 almost 900,000 producers grew maincrop potatoes (56 per cent of all French agricultural holdings) and 760,000 of these were growing less than 0.5 hectares. The average area of potatoes grown in 1970 was 0.3 hectares. These very small growers have historically made a very significant contribution to the total area cultivated and this fragmented structure of production goes a long way to explaining the very high degree of price instability found within the French potato marketing system. Undoubtedly the concentration of ownership of the potato production sector will have increased since 1970. The evidence available from more recent assessments of the location of potato production indicates that a greater proportion of total area is now being cultivated in those regions of the country which are best suited to potato production.

The output from the production sector has not decreased as sharply as the area because of improvements in yield per hectare. At the end of the Second World War almost 16 million tonnes of potatoes were being produced of which 14 million tonnes represented the share of maincrop potatoes. In 1977 the total output was just over 7½ million tonnes of which maincrop potatoes comprised 83 per cent of the total, early varieties 8 per cent, starch 5½ per cent and seed 3½ per cent.

When one considers potatoes for human consumption one must not ignore the contribution of supplies from private gardens as these can make an important contribution to the overall production of potatoes for human consumption. In estimates made by Young (1978) for the crop year 1974/75 total available supplies of potatoes for human consumption represented 7.4 million tonnes. This comprised 6 million tonnes from farms, 0.6 million tonnes from the early potato crop, 0.6 million tonnes from private gardens, 0.1 million tonnes from imports (mainly early potatoes) and 0.06 million tonnes from the seed crop. Of these 53½ per cent were used for consumption in the home, 10½ per cent for consumption outside the home, 5 per cent for the manufacture of processed products, 2½ per cent were used as non-certified seed, 3 per cent were exported, ½ per cent were taken off the market by the intervention agency SNIPOT and the rest, 25 per cent, represented losses and rejects from the ware market.

France is an important exporter and importer of potatoes. Imports of maincrop potatoes have been restricted by past government policies but the import of early potatoes has been an important feature of the potato sector. France is also an important exporter of potatoes although the quantities exported vary quite considerably from year to year depending on the size of the harvest. The exports comprise mainly maincrop potatoes although an important early potato export trade has also been developed. The bulk of the imports of early potatoes are from Mediterranean countries and exports are mainly destined for Italy and West Germany, although Belgium/Luxembourg can also be another important destination.

Consumption of fresh potatoes per head of the population has persistently declined and are now understood to be around 75 kilograms although consumption levels are not very well documented. There are very large differences between the regions. In the north consumption is almost twice the national average and those in southern regions exhibit much lower levels of potato consumption as do those in the Parisian region. There are also strong regional differences in the quantity of potatoes available from private supplies. This is highest in the western regions such as Brittany and Pays de la Loire.

Among the varieties grown for the maincrop potato market Bintje has overriding importance. In a survey of 24 of the most important potato growing departements conducted in 1976, 75 per cent of the maincrop potato area consisted of Bintje. Other data suggest that the figure may be even higher when those potatoes which are not grown for market sale are excluded. In the regions Nord and Picardie the maincrop potato area is almost exclusively planted with Bintje potatoes.

The potato marketing system of France has been subject to the same kind of pressure which has imposed changes on other potato marketing systems in the EEC, in particular the growth of supermarkets and the development of the processing sector with their more specific quality requirements. In addition to these changes there has been an attempt to amend the structure of the marketing system through the Loi d'Orientation of 1960 and the Loi Complémentaire of 1962. This reform promoted the organisation of the sales of products from agricultural holdings through various forms of producer groupings. The reform gave specific incentives for the establishment of

producer groups[1], but more than this it introduced a possible structure whereby agricultural markets could be regulated through producer groups with the co-operation of other important groups in the marketing system. As it was originally conceived, the law had three stages with respect to the organisation of the market. As a first stage four types of organisations (associations, syndicats, co-operatives and SICA) could be recognised as producer groups, and as a result they could benefit directly from certain aids for establishment and investment and receive special advantages compared to other forms of business. As a second stage the law provided the facility for the establishment of regional Comités Economiques Agricoles (CEAs) covering individual products or groups of products, of which each recognised producer group would be a member. These CEAs would attempt to harmonise and co-ordinate the operations of each individual producer group member in a region according to the needs of the market and under common rules. The CEAs can also operate price stabilisation funds (fonds de péréquation) which take contributions from producers in high price years and return them in poor years. In addition they also establish agreements with other professions concerned with the marketing of the product and establish model contracts for operations with these professions should it be necessary. As a third stage the CEAs had the power to extend the validity of their imposed rules for production and marketing to cover all producers in a particular area of activity should more than two-thirds of the producers of the products in the region agree to this.

This final stage has only been applied in the potato industry to seed potatoes and early potatoes in Brittany. In the maincrop potato sector the impact of the reforms has been much lower than in other agricultural sectors. The main reason for this has been the dispersal of maincrop potato production throughout all regions of France so that no individual region could effectively regulate the market without having its plans disrupted by producers who were not organised in other regions. Three CEAs were set up to organise the maincrop potato sector in Nord, Picardie/Ile de France and Brittany, although only the first of these can claim any real success in organising the potato sector of the region. The major problem in all the regions has been the lack of support from individual members and resistance to the formation of producer groups. Even in the Nord region the success of the CEA has been only modest, although in 1970 it was claimed that more than 70 per cent of supplies were channelled through producer groups in the region (but by 1977 this support was reduced to 45 per cent and is now believed to have dwindled further). Generally farmers in France have resisted attempts to group together for the purpose of regulating the market, mainly because they have traditionally speculated on the potato market and being a member of a group restricts their freedom of action. There has also been concern about the costs of membership of a group largely because attempts to set up funds to stabilise producers' returns from the potato crop from year to year have proved to be very expensive.

---

1 The term 'producer group' is frequently applied to any form of producer grouping, when in certain countries the term can have a very precise meaning, often defined in law. In this section the French usage is adopted (as defined in the Loi d'Orientation) and it should not be confused with Commission, West German or other definitions.

Among those organisations which could be recognised as producer groups are co-operatives and SICA. The most important differences between these two organisations are that a SICA can have members who are not farmers, although an agricultural collective interest must be maintained, and trade can be carried out with non-members up to a maximum of 50 per cent of the total turnover. Surpluses are distributed to members in proportion to the trade of the members and is not normally taxed, although profits arising from operations with non-members are taxed at the same rate as applies to private companies. The co-operatives have rather stricter rules. Since 1972 they have been authorised to provide services for non-members of up to 20 per cent of their annual turnover. As they were given a key role in the Loi d'Orientation reform, SICA and co-operatives have been given preferential treatment within the marketing system and consequently their market position has been supported. There are no accurate figures to indicate the market share of co-operatives and wholesalers although Comité National de la Pomme de Terre (CNPT) indicated that in 1974/5 55 per cent of those graded potatoes put on to the market originated from private wholesalers, 24 per cent from co-operatives/SICA and 21 per cent from producers. Although the situation may well have changed since 1974/75 (and the accuracy of those figures was slightly suspect anyway) it is generally accepted that private wholesalers still account for by far the largest share of the potatoes put onto the ware market.

Very few of the wholesalers involved in the potato marketing system are specialised in handling potatoes and consequently there are very few large-scale potato wholesalers. The co-operative sector is much more concentrated and there are a number of co-operatives who handle fairly large quantities of potatoes from year to year. To a certain extent the dispersal of potato production has been an important factor restricting the development of specialist potato wholesaling organisations. But also important has been the absence of any real impact of the potato processing sector on the wholesale trade. In the Netherlands the wholesalers are an integral part of the marketing system which supplies the potato processing sector whereas in France and to a lesser extent West Germany wholesalers have been excluded from participating in the development of this sector.

Attempts to organise the market through producer groups have already been outlined but there had been attempts to organise the potato market prior to the reforms of the early 1960s. Attempts to control price stability began in 1955 with the establishment of La Societé Nationale Interprofessionnelle de la Pomme de Terre (SNIPOT). SNIPOT attempted to regulate supplies coming on to the market by taking control of a regulatory stock of potatoes at the beginning of the season (in addition imports were controlled through a minimum import price system). Depending on the market situation, these potatoes could either be sold back on to the market, or sold on non-competing markets, or destroyed. Additional interventions were undertaken if the price situation was serious. SNIPOT's operations were funded by le Fonds d'Orientation et de Regularisation des Marchés Agricoles (FORMA) an official organisation which came into existence as a result of the reforms of the early 1960s and assumed responsibility for directing government support and aid to the different agricultural sectors. SNIPOT's efforts to control price instability did not meet with much success. During the 1960s and early 1970s the intention was that the SNIPOT system would involve producer groups formed through the Loi d'Orientation but, because of the lack of support for producer groups, little success was achieved. Towards the end of the 1960s and the early 1970s it became apparent that a completely new approach to regulating the potato market

was necessary. It was recognised that one major reason for price instability was the lack of market information and consequently a government office (Comité National de la Pomme de Terre, CNPT) was set up, with the role of collecting much more comprehensive statistical information about the industry. After two years and the establishment of a more acceptable statistical background on which to base actions to regulate the market, an interprofessional organisation came into existence under the terms of a law passed in July 1975. This organisation (Comité National Interprofessionel de la Pomme de Terre, CNIPT) will continue the work begun by CNPT on collecting statistical information on the market and it will attempt to improve the value of the production by improving quality, promotion and information and developing new markets. It will also attempt to develop interprofessional agreements through contracts between producers, wholesalers, processors and distributors. It is not able to intervene on the market to any great extent mainly because frontiers are open to imports. As such the CNIPT does not represent an attempt to organise the potato market in France but has a much more modest role and any real effort to attempt to regulate the market awaits the implementation of an EEC regime for potatoes.

THE MANUFACTURE OF POTATO PRODUCTS

Historical development

The potato processing industry of France began in the late 1950s and consequently it is still a relatively young industry. Its development since that date has been somewhat slower than the rate of development which has taken place in countries such as the United Kingdom, West Germany and the Netherlands. The manufacture of dehydrated potato products began on a very small scale at the beginning of the 1960s although production on an industrial scale did not begin until 1963 when Nestlé opened the first of their two French based factories to produce potato flakes. The product proved to be a great success and in the following years Nestlé were joined in the market by Flodor, Vico (a co-operative), Astra-Calvé (a subsidiary of Unilever) and Knorr. The latter company entered the market selling potato granules but the product was not successful and was soon abandoned in favour of flakes. A later entrant to the sector was the co-operative Beau-Marais. Astra-Calvé ceased the production of flakes in the middle of the 1970s. Nestlé, because of their early entry into this industry, established a very impressive head start in the market and consequently they hold a very important position in the retail market with their branded product 'Mousline'. Some of the dehydrators also produce potato pieces usually in the form of slices or cubes. These are used for making gratin de pomme de terre (a dish which incorporates sliced potatoes in a cheese sauce) and soups. They also produce preparations which can be used for the making of pommes dauphines, pommes croquettes or pommes galettes in the home.

The crisp industry began in 1958 when M. Brueder, an owner of starch factories, set up a small crisp production unit after a visit to London. In 1960 production began on a larger scale. Flodor were joined in the market by Vico and Samo (a subsidiary of the vegetable oil refiners Unipol) in the mid-1960s. In the mid-1970s Samo ceased production of crisps after they had changed the location of their factory from the south of France to Nord. In addition to the major manufacturers, a number of other organisations are believed to have manufactured crisps from time to time on a very small scale. They include the vegetable oil refiners Société Normande d'Huilerie

(Normandy), Astra-Calvé, the biscuit manufacturers IPA, Gringoire, and SATPA (another Unilever company). Flodor, like Nestlé in the dehydrated potato market, had the advantage of being the first organisation in this market and have established themselves as the most important manufacturers of crisps. Recently Nestlé launched some extruded products based on potato flake and consequently joined the snack market.

The manufacture of other potato products has been relatively insignificant in France. In this group one can include french fries, both chilled and frozen, canned potatoes and potatoes which have been sterilised and packaged in vacuum under polythene film. Unfortunately it is not possible to chart the development of each of these sectors because separate data does not exist. It is understood that french fries and other fried non-snack products were produced for the first time in 1970 when Bonduelle began french fry production. A number of organisations entered the market, although none have operated on the kind of scale which one finds in the Netherlands, West Germany and the United Kingdom. From a fairly early stage these organisations began to produce a range of other products such as pommes dauphines, croquettes, pommes noisettes, pommes sautées and pommes galettes in addition to french fries. The manufacture of canned potatoes is understood to have begun in the mid-1960s and has developed relatively slowly. The potatoes have been canned by the major organisations who are principally involved in producing canned vegetables and fruits. At the beginning of the 1970s in an effort to utilise a greater proportion of the ware potato crop, a number of organisations began producing sterilised potatoes vacuum packed under plastic film. A regular market was developed for this product and it competes with the canned potato. The quantities of potatoes used by the three major organisations producing this product are believed to be modest.

At the beginning of the 1960s the total quantity of potatoes processed into potato products was less than 10,000 tonnes (see Table F1). The quantities utilised have increased quite rapidly up until the early 1970s, since when it has evened out. The industry suffered quite seriously during the drought year of 1976 and consequently in this year the throughput of potatoes was reduced quite substantially. The most rapid period of growth came during the late 1960s/early 1970s and this reflects the rapid development of the market for potato flakes during this period. As is the pattern in other countries, the development of the potato flake sector is rather uneven mainly because of the effects on demand of variations from year to year in the price of fresh potatoes. The crisp market has shown much more consistent growth although the quantity of potatoes used for the manufacture of crisps in France has fallen since 1973/74, suggesting that the rate of development has been arrested. In 1977/78 almost 70,000 tonnes of potatoes were being utilised for the manufacture of crisps. The most rapid period of growth for all the other potato products has come within the 1970s and this growth is largely accounted for by the development of the french fry and other fried non-snack products. According to GNIPTIT (Groupement National Interprofessionel de la Pomme de Terre Industrielle et des Industries de Transformation) the development of the sector was disrupted by the difficulty in obtaining potatoes during the drought year in 1976, although data available from the trade associations of the manufacturers of frozen products and canned products contradict this (see Tables F2 and F3). The output of deep-frozen french fries and other fried non-snack products has increased quite dramatically and by 1978 it represented almost 23,000 tonnes, of which french fries represented 17,000 tonnes. It should be noted that some of the fried non-snack products

Table F1 Quantities of potatoes used for processing potato products and final product (tonnes)

year	flakes		crisps		other products (estimated)		total	
	potatoes	final product	potatoes	final product	potatoes	final product	potatoes	final product
1959/60	5,700	970	1,600	400	1,000	500	8,300	1,870
1960/1	5,400	950	3,200	800	1,500	750	10,100	2,500
1961/2	4,200	800	6,800	1,700	2,500	1,250	13,500	3,750
1962/3	5,400	850	16,100	4,025	4,500	2,250	26,000	7,125
1963/4	15,595	2,461	22,000	5,500	6,000	3,000	43,595	10,961
1964/5	24,205	3,840	28,687	7,170	7,000	3,500	59,892	14,510
1965/6	31,680	5,082	31,200	7,800	7,000	3,500	69,880	16,382
1966/7	42,710	6,875	35,200	8,800	7,000	3,500	84,910	19,175
1967/8	48,243	7,770	35,600	8,900	7,000	3,500	90,843	20,170
1968/9	71,306	11,286	43,200	10,800	10,000	5,000	124,506	27,086
1969/70	115,465	18,146	52,000	13,000	12,000	6,000	179,465	37,146
1970/1	155,951	25,067	60,000	15,000	16,000	8,000	231,951	48,067
1971/2	145,549	22,141	67,996	16,999	20,000	10,000	233,545	49,140
1972/3	162,989	25,029	80,000	20,000	30,000	15,000	272,989	60,029
1973/4	212,837	33,016	80,000	20,000	40,000	20,000	332,837	73,016
1974/5	216,032	33,996	71,400	17,850	50,000	25,000	337,432	76,846
1975/6	205,951	28,245	69,120	17,280	60,000	30,000	335,071	75,525
1976/7	132,854	17,529	62,092	15,523	45,000	22,500	239,946	55,552
1977/8	190,511	28,446	69,744	17,436	52,000	26,000	312,255	71,882

Source: GNIPTIT.

Table F2 The output of deep-frozen potato products (tonnes)

year	french fries and other non-snack products[a]	pommes dauphines
1967	49	
1968	43	
1969	-	434
1970	3,897	1,361
1971	5,271	2,060
1972	6,613	2,444
1973	8,609	3,588
1974	7,162	3,342
1975	9,157	4,979
1976	19,912	7,399
1977	14,752	5,656
1978	22,734	5,563

a e.g. pommes noisettes, croquettes, galettes and sautées.

Source: Private communication with Syndicat National des Produits Surgelés et Congelés.

Table F3 The output of canned potatoes (tonnes)

year	quantity of finished product	quantity of potatoes processed[a]
1967	325	361
1968	943	1,047
1969	1,029	1,143
1970	1,836	2,040
1971	1,506	1,673
1972	2,020	2,242
1973	3,984	4,422
1974	3,857	4,281
1975	9,572	10,625
1976	16,250	18,037

a Estimated by the author according to the ratio 10 kg of raw potatoes for 9 kg of final product.

Source: Private communication with Confédération Française de la Conserve.

included in Table F2 will include potato flakes, and therefore when assessing the total quantity of potatoes used by the potato processing sector care must be taken not to double-count.

To summarise, the development of potato processing in France has been much more uneven than in several other European countries; both the crisp and dehydrated sector have become fairly well established although the initial period of rapid growth of these sectors appears to be over and future progress will not be so easily achieved. The area which appears to have the greatest potential for development is the french fry and other fried non-snack product sector. This sector is still in its infancy.

The industry today: utilisation of potatoes, structure and location

The manufacture of dehydrated potato products, most of which comprises potato flakes, dominates the potato products industry of France. In 1977/8, 61 per cent of the potatoes moving into the potato products industry were being used by the manufacturers of dehydrated potato products. The Nestlé organisation SITPA accounts for the bulk of potatoes utilised in this sector. Vico and Flodor are the next most important manufacturers and they are followed by the two smallest producers SPM/Sica Champic (jointly owned by Société des Produits de Mais (SPM), the French subsidiary of the United States based multi-national, Corn Products Corporation and some co-operatives) and the co-operative, SCA Beau Marais.

The manufacturers of crisps accounted for 22 per cent of the potatoes used in the manufacture of potato products in 1977/8 and the sector is dominated by the two companies Flodor and Vico, of which the former is understood to hold the largest market share. Snack products made from potato flakes are also produced by these two organisations. In addition a number of biscuit manufacturing companies such as Belin, Biscuitère, Nantaise and Bahlsen produce snack products and they were joined recently by SITPA.

There is less information available on the structure of that part of the industry which is producing potato products other than dehydrated products and crisps because not all manufacturers are members of GNIPTIT (see later). According to GNIPTIT 17 per cent of the potatoes used in the industry are utilised for the manufacture of these products. Three of these companies are producing vacuum packed sterilised potatoes, of which the two largest are the Co-operative de Pomme de Terre Luneray and UNICA-SICA Santerco. The principal manufacturers of french fries are Bonduelle, the co-operative Union Paysanne, Vico and Picardie-frites. In addition there are smaller organisations such as Ets Mester and Société de Transformation Agricole du Belinois and a new factory set up in 1978 by the organisation Vivagel, a subsidiary of the frozen food manufacturers Compagnie du Froid Alimentaire. For several years there have been rumours that one of the major companies producing french fries on a large scale elsewhere in Europe would be establishing a major plant in France for the manufacturing of french fries. Should this investment proceed then the face of the French potato products manufacturing sector could be changed overnight[1].

The manufacture of canned potatoes is carried out largely by those companies which specialise in canning fruits and vegetables.

---

1 See footnote to page 135.

Two organisations, Vico and Flodor, are involved in manufacturing more than one of the major groups of products. Consequently they are in an extremely good position to utilise the whole crop and can take advantage of full utilisation of all the raw material entering their factories. This particularly applies to Vico which is involved in the manufacture of flakes, crisps and french fries.

Flodor, SITPA and Bonduelle are the only private companies involved on any scale in the manufacture of potato products in France although as noted above another company may soon begin production in the country. An interesting feature of the ownership of the potato processing sector of France is the presence of a number of organisations which are co-operatively owned, one of which, Vico, maintains a very important position in the industry. In no other country in the EEC are there so many co-operatively owned potato processors, and to a large extent co-operatives owe their prominent position in the sector to the support and concessions which they have been given by successive French governments. The form of incorporation known as SICA provides the opportunity for the establishment of joint ventures between private and co-operative organisations, and this form of participation in the potato products sector of France has been adopted by SPM.

As can be seen in Map 3[1] there is a strong concentration of potato processing factories in the Picardie and Nord regions and the quantity of potatoes being processed outside this area is very small. A location to the north of Paris, in the best potato growing regions of France, not only provides advantages with respect to raw material supply but it is also conveniently placed to meet the requirements of the major Parisian and northern France markets. It must be recalled that consumption of potatoes is far more established in the north of France and the same also applies to potato products. Organisations which choose to locate large scale processing plants outside these major production areas would almost certainly experience difficulty in terms of the continuity and quality of the raw material supply. Most of the major manufacturers of potato products have chosen to locate their factories in Picardie. This region is particularly attractive because the agricultural structure is less fragmented providing opportunities to establish manageable raw material supply systems.

A major constraint on the expansion of the potato processing sector in Nord has been the difficulties of obtaining raw material and resistance of many of the farmers to take up of the offer of fixed price contracts whenever these have been made available. In this region farmers have traditionally speculated with the potato crop and are reluctant to change their ways to meet the requirements of the processing industry.

The potato marketing system and raw material supplies

All the major potato processors prefer to utilise the variety Bintje which is widely available on the ware market. However, if one excludes the co-operatives (who are supplied by their own members), most of the other major manufacturers have set up their own procurement systems buying directly from farmers or groups of farmers to ensure that they have access

---

1 See Appendix I.

to raw material which is of suitable quality for the manufacture of products. One major company, Flodor, purchases the bulk of raw material requirements on the basis of direct contracts with individual products. Flodor is located in an area of Picardie where such a procurement policy is possible, as the relatively small number of suppliers needed to maintain throughput is easy to manage from an administrative point of view and there are few problems of communication. SITPA have chosen to purchase their raw material through recognised producer groups which are located close to the two factories which they operate, although contracts with individual growers are also used to supplement the supplies purchased through the producer group. Although the producer groups are very closely involved in the organisation of the supply of raw material and the negotiation of the contract, SITPA has separate contracts with each individual producer and consequently it is the producer which has the legal responsibility to supply potatoes, although in practice the producer group might assume some of this responsibility. Superficially, there may not seem to be very large differences between the supply mechanism established by Flodor and SITPA, as each have contracts with individual growers. However the presence of a formally organised producer group means that in practice the procurement system is very different, for not only is the group involved in the negotiation of contract prices and conditions, but also it can pursue the interests of members of the group along a number of other dimensions. For example, a producer who fails to supply potatoes which are of suitable quality according to the terms of the contract can be excluded from supplying the company in future years; however the basis upon which the farmer is excluded will have been negotiated by the producer group with the company.

The large canning company Bonduelle, although not operating on the same kind of scale as Flodor and SITPA, has also had to face up to the problem of establishing a raw material procurement system. Bonduelle purchase potatoes on a completely different basis to other organisations. They have attempted to obtain raw material from wholesalers and have not set out specifically to establish direct contracts with growers. Recently, their experiences with the quality of potatoes bought in France has meant that they have been looking towards the Netherlands and Belgium as their source of supply, and potatoes from these destinations represent an important part of their raw material supply.

Those organisations which are incorporated as co-operatives or SICA obtain their raw material from within the organisation, although they are able to purchase raw material from outside the organisation should it be necessary. One of these, SPM/SICA Champic, represents a joint venture between four co-operatives involved in the production and selling of potatoes and SPM. Together they have formed a joint company to procure potatoes and process and sell potato products. The precise financial arrangements involved are fairly complicated but the basic philosophy is that SPM provide the management skills through a separate company, and the co-operatives provide potatoes of suitable quality. In these circumstances it is the co-operatives who buy potatoes from their members on contract, and then sell to the management company on a separate contract. There are certain tax advantages in operating as a SICA and consequently such a form of incorporation has certain advantages for any company wishing to invest in the potato processing sector, although these benefits are gained at the expense of sacrificing some autonomy. Of course there are some benefits from producer involvement in such a company, but perhaps the major problem from the point of view of the non-co-operative interests is that such an organisation might find itself less able to be flexible in its response to

changing market circumstances. The ability to operate flexibly is crucial in a market which varies quite considerably from year to year.

Co-operative involvement in the ownership of potato processing plants in France is perhaps one of the most interesting features of the potato processing sector. As far as raw material procurement is concerned, the co-operatives do not have to set out to establish specific procurement systems because the supplies are available from their own members. Usually members are paid an average price after the deduction of charges for processing costs plus an allowance for storage.

As has been noted before, to a large extent co-operatives owe their position to government incentives for co-operatives and in particular to the reforms of the early 1960s. But perhaps it would be unfair to place too much importance on the aids or concessions, for much of the success of co-operatives derives from a strong motivation on the part of the agricultural sector for co-operation to succeed. To a certain extent their success may owe a lot to good fortune as the promotion of 'agriculture de groupe' during the 1960s coincided with the birth of the potato processing industry in France and consequently some co-operatives were given a helping hand at the right time.

There are several reasons why wholesalers are not used to any great extent for supplying the potato processing sector. There is a marked absence of wholesalers handling large quantities of potatoes and therefore few can guarantee a constant supply of potatoes to the processor. Also, in France the quality of potatoes coming onto the ware market is quite variable; consequently there is a need for close communication between growers and processors to ensure that all is being done to maintain quality. Where procurement is particularly difficult to organise or where a particular size of potato is required, wholesalers may play a role but generally it has been more satisfactory for manufacturers to choose between contracting with individual growers or contracting with grower organised groups. Additionally the incentives given to associations, syndicats, co-operatives and SICA through the Loi d'Orientation has put them in a stronger position and all those producer groups supplying manufacturers will have benefited from some assistance. Which alternative is taken depends mainly on the overall philosophy of the organisation although other structural factors influence the decision, notably the fragmentation of the agricultural structure.

Apart from the co-operative manufacturers who usually pay producers on the basis of average prices after the deduction of costs, all the other organisations will be purchasing potatoes on fixed price contracts (although in some cases growers are given the option of selling at a price which is related to the market price). It is very unusual for prices to be paid on the basis of dry matter content, as most manufacturers are quite content to specify the variety Bintje which is known to have a higher than average dry matter content. All contracts will include some procedure for the measurement of the number of defective potatoes delivered. If purchases are made from wholesalers or co-operatives on the ware market then it is normal for RUCIP contracts to be used.

Raw material supply during the difficult summer months is usually met by purchasing supplies from southern France. These can be obtained by purchases on the free market or in some cases they are bought on the basis of fixed price contracts made with producers or producer organisations.

For some organisations, such as Bonduelle, the summer does not pose a problem because they are then manufacturing frozen products other than potatoes.

External trade

As can be seen in Table F4, France imports potato flakes and french fries on a regular basis. The importation of crisps is negligible. The import of potato flakes was also insignificant until the early 1970s, since when modest quantities have regularly come into the country, mainly from the Netherlands and Belgium/Luxembourg. The table also shows that France imported very substantial quantities of potato flakes as a result of the drought in 1976/7. These were imported from North America although it is noticeable that these importations have continued into 1978 and still represent a major problem for the manufacturers of dehydrated potato products. Small quantities of dehydrated potato pieces are also regularly imported, again mainly from the Netherlands but also from West Germany.

The biggest quantity of imports comes in the form of frozen french fries and these represent an important share of the French market for this product. According to figures collected by FICUR (Féderation des Industries et Commerces Utilisateurs des Basses Temperatures) imports accounted for 50 per cent of the quantity sold on the internal market in 1976, 66 per cent in 1977 and 50 per cent in 1978. Imports come mainly from the Netherlands and Belgium, although other countries sell small quantities in France.

France also exports small quantities of potato products. The most important exports are crisps, most of which are sold onto the West German and Belgian markets (these two countries usually account for at least 90 per cent of exports). Small quantities are sold to many other countries, most of which are part of the Zone Franc. The major market for the export of potato flakes is West Germany although Belgium/Luxembourg and Italy are also important regular customers. As can be seen in the table, small quantities of frozen french fries are also exported and, although no data on the destination of these is available, it is understood that most go to West Germany.

Demand

According to information presented in a Libre-Service Actualité report (No. 678) in 1976, three-quarters of the sales of dehydrated potato products (of which flakes comprise 96 per cent) were direct to consumers with sales to catering establishments and industrial users sharing the rest of the output. Since that date the industrial sector has probably increased with the increase in demand for snack products and for frozen fried non-snack products which include potato flakes. Caterers are used to flake and continue to prefer it to granules for this reason. Some companies (e.g. Beau Marais) have a heavy emphasis upon servicing the catering market, and others (e.g. Vico and Flodor) are involved in supplying the private label trade which is understood to represent an important share of the retail market. According to Libre-Service Actualité, in the retail market the biggest consumers of potato flakes are the better off social economic classes, younger people, those who live in large towns, and particularly the Parisian region, and those families with children.

Table F4 Exports and imports of potato products (tonnes)

calendar year	export				import			
	dehydrated potato pieces	flakes[a]	crisps[b]	french fries[c]	dehydrated potato pieces	flakes[a]	crisps[b]	french fries[c]
1965	n.a.	527	n.a.	n.a.	n.a.	2	n.a.	n.a.
1966	n.a.	853	n.a.	n.a.	n.a.	146	n.a.	n.a.
1967	n.a.	733	n.a.	n.a.	n.a.	48	n.a.	n.a.
1968	n.a.	975	n.a.	n.a.	n.a.	21	n.a.	n.a.
1969	n.a.	1,313	n.a.	n.a.	n.a.	402	n.a.	n.a.
1970	n.a.	2,190	n.a.	n.a.	n.a.	343	n.a.	n.a.
1971	n.a.	2,288	n.a.	n.a.	n.a.	49	n.a.	n.a.
1972	n.a.	2,490	n.a.	n.a.	n.a.	260	n.a.	n.a.
1973	n.a.	2,879	n.a.	n.a.	n.a.	3,866	n.a.	n.a.
1974	2,595	4,615	5,968	n.a.	451	2,540	244	n.a.
1975	772	3,569	3,150	1,404	520	1,384	63	13,839
1976	124	3,441	3,300	5,746	709	12,583	391	15,209
1977	150	4,906	3,061	2,945	746	19,060	445	24,471
1978	1,149	4,006	3,493	4,243	592	1,984	74	20,684

a includes potato flour for human consumption although the quantity is believed to be small.

b includes other pre-cooked products although the quantity is believed to be small. Customs data on crisps are not available before 1974.

c includes other fried non-snack products but the quantity is small.

Source: GNIPTIT, FICUR and Nimexe trade statistics.

It is difficult to estimate a figure for consumption per person per year as production and trade data are available for different periods, and in any case calculations of apparent consumption may be unreliable particularly if it is possible to store a product. However, bearing in mind these reservations, it seems as though roughly 3.5 kilograms (in fresh potato equivalents) of potato flakes and granules were consumed in 1977 and 1978. The consumption of crisps calculated on the same basis works out to be just over 1 kilogram per person for the same period and consumption of frozen french fries and other fried non-snack products (excluding pommes dauphines) works out at 1.25 kilograms per person.

Crisp consumption is much higher during the months of May to September with peaks in July and August. This points to one of the most popular situations in which crisps are consumed, namely on picnics, although they are also popularly used as a snack accompanying aperitifs and as part of a meal. To meet the aperitif market a number of specialised products have been produced which include pommes gaufrettes (thicker waffle shaped crisps) and pommes pailles (potato sticks). The consumption of flavoured crisps in France is very small. Paprika, bacon, onion and several other flavours are produced but they have not proved to be acceptable to the French palate. As in other parts of the EEC apart from the United Kingdom, Ireland and to a lesser extent Italy, small size bags (25 or 30 grams) are less common, mainly because crisps are less commonly eaten as snacks during the day, and purchases by children are less important. They account for less than 5 per cent of sales.

The consumption per person of frozen french fries is increasing very rapidly. The biggest market for these products is in catering establishments and the retail market has not yet developed to the same extent. A major part of this growth has been exploited by manufacturers in other countries and domestic manufacturers have found it difficult to make progress in this market. It is difficult to establish the reasons for the strong import (particularly Dutch) domination of the market. In France one frequently hears remarks about subsidies given to Dutch french fry manufacturers (which are often picked up and repeated in the other countries) but the author has found no evidence of such activities in the Netherlands. It seems much more likely that the competitive position of the Dutch in the French market results from the economies of operating on a much larger scale and from buying raw material from a potato marketing system geared to meet its requirements.

Institutional factors

The organisation GNIPTIT has already been mentioned in this section with respect to the provision of statistics on the potato processing sector. It is an organisation formed in 1956 with the declared object of representing the common interests of the producers of potatoes for processing (for starch and human consumption) and the manufacturers of potato products. It also acts as the main point of contact between the professions interested in the manufacturing of potatoes, and within its framework representatives of producers can meet the processors to discuss common problems. GNIPTIT has two sections, one of which covers the starch industry and the other the manufacturing of products for human consumption.

Unlike many interprofessional bodies covering the agricultural sectors of France, GNIPTIT exists on a completely voluntary basis. In the case of the starch industry it has established an agreement between the different

professions (an 'accord interprofessionnel') which constitutes a single national contract between producers and starch manufacturers covering the selling of potatoes for the starch industry. Such a contract is not unique in France. There are national contracts between processors and producers for a number of other agricultural products, complete with conditions of supply and price clauses. They have usually appeared in specialist product areas (such as peas) where large groups of producers have combined to negotiate a single contract with a large processor. Such contracts have been particularly common where there is a strong concentration of ownership among the manufacturers. The national starch potato contract is perhaps unusual in that the sensitive issue of price is not subject to negotiation as this is laid down by Brussels as part of the EEC regulations for potato starch.

There has naturally been some pressure for the establishment of a similar agreement to cover potato products for human consumption. This issue has been under discussion with GNIPTIT for a number of years and in June 1979 an 'accord interprofessionnel' was signed between producers and manufacturers through their respective trade associations. Up until then, the nearest that the potato processing sector had got to the establishment of an interprofessional agreement came during the very difficult years of 1976/7 when market prices exceeded contract prices by an extremely large margin because of the drought that summer. Negotiations took place within the framework of GNIPTIT for an amendment to all existing contracts which would apply to all potato manufacturers. As a result, manufacturers agreed to increase all contract prices by a factor of two and decrease all contract commitments by a factor of 0.5.

The new agreement is a long way from being a national contract for potatoes destined for processing products for human consumption, and its limited coverage reflects the problems of reaching any national agreement at all in an industry which comprises companies with so many different needs. The 'accord' specifies that:

(a) Agreements between processors and producers will be on the basis of contracts specifying variety(ies), and conditions. The contracts will be on the basis of quantity, but guaranteed by an indication of area planted.

(b) Subscribers who have signed and satisfactorily fulfilled contracts in previous campaigns will be given priority for contracts. For supplementary purchases the processor will give preference to contract holders at prices and quality equal to those offered to outside suppliers.

(c) Processors will submit annual declarations (before May 1st) to GNIPTIT indicating the number of producers who provide potatoes on contract and the quantity contracted. At the end of the season they will declare the quantity procured in supplementary purchases.

(d) The price will be fixed annually between the manufacturer and the most representative organisation of producers (or with producers themselves if no such organisation exists). The quality criteria shall be determined at the level of each firm.

(e) Payment will be carried out under conditions laid down in the contract or, if not, within 60 days of delivery.

(f) Except with the agreement of the two parties, the tonnage delivered must be the same as stated in the contract. The case of 'force majeur', duly certified, can provide total or partial cancellation of the contract.

(g) Apart from 'force majeur' either party may freely negotiate compensation if a contract cannot be honoured.

(h) In the case of dispute the parties may refer the issue to a Commission comprising two representatives of producers and two of manufacturers each being proposed by the respective trade association.

(i) The Commission decides on the basis of majority and the decision must be accepted.

(j) A levy will be collected to finance the Federation Nationale des Producteurs de Pommes de Terre Industrielles (FNPPTI).

The 'accord' is backed up by a decree under the terms of the 1975 interprofessional laws . This law gave interprofessional organisations (in this case CNIPT (see later)) the powers to make agreements legally enforceable on the members of all the participating trade associations as long as they are part of the interprofessional organisation.

Despite its lack of substance it is interesting that an 'accord' has been passed. Manufacturers in several other countries might baulk at the thought of being legally obliged to provide information on throughput and supplies (although throughput information is collected compulsorily in the Netherlands). Apart from being compelled to provide information on throughput (which used to be provided to GNIPTIT voluntarily prior to the signing of the 'accord') and the number of producers, the agreement means very little in substance because most of the manufacturers already operate broadly on the basis outlined in the 'accord'. In fact, for the most part the 'accord' appears to state the obvious. Perhaps the most innovative element is the establishment of the Arbitration Committee which provides some means of overcoming disputes concerning contracts although it is difficult to understand why independent members are not also appointed to avoid deadlock. In view of its thinness one might ask why it was passed at all. Perhaps it formally recognises an area of concern in the industry and represents a genuine attempt on the part of all concerned to try to solve some of these problems. However in its present form it seems to do very little which could not otherwise have been achieved by the normal voluntary negotiations between processors and their suppliers.

As the extension of the 'accord' only applies to members of trade associations which participate in CNIPT, a number of organisations are not affected. In particular this applies to the french fry manufacturers Bonduelle.

To complement the reforms included in the Loi d'Orientation of the early 1960s there have been a number of attempts to introduce changes to 'vertical' relationships within an industry. The Loi d'Orientation concentrated more on 'horizontal' relationships to ensure that the production sector was better organised to face the future (although it attempted to modify vertical relationships to a certain extent). Recent emphasis on vertical relationships recognises the need for an entire industry to make advances and that reforms at one level have an impact on other levels

within an industry. Attempts were made to formalise vertical relationships through a law in 1964, but it was not until 1975 when a new law relating to interprofessional organisations came into existence, that any progress was made in terms of establishing the interprofessional bodies and the signing of interprofessional agreements. The law enables parafiscal levies to be collected compulsorily from all the members of an agricultural sector to finance activities of benefit to that sector. In the potato sector CNIPT was established in 1977 to provide certain services to the industry.

The manufacturers are represented on the CNIPT and pay levies to support this organisation. In return the processors get some allocation from the promotion budget of CNIPT for the development of potato product markets. (In exactly the same way as the Produktschap gives money to NIVAA for the promotion of potato products in the Netherlands).

The attempts to organise the potato market have already been discussed. It has been shown that the position of co-operatives in the supplying of potatoes to processors and manufacturing itself have been influenced by various measures to assist co-operatives and other forms of producer groupings. In addition the development of new manufacturing plant in France may well have been hindered by the operation of a minimum import price system which was in operation until 1977. Manufacturers who established themselves in France whilst this policy was in operation would have been put in a position of buying raw material at higher prices than their competitors but without any protection for their product at the French frontier. In particular this might well have affected the development of the more speculative french fry sector in France.

Several organisations expressed concern at the expense of effluent treatment in France, a concern which is common to manufacturers in most EEC countries. Laws in 1964 and 1966 led to the establishment of six public administrative authorities with the responsibility for water resources management. Consumers pay for extraction and consumption of water and for pollution. The pollution levy is based on the amount of pollution released in a normal discharge day in the month of maximum discharge. The rates vary according to the location of discharge outlets and the nature of the body of water to which the effluent is discharged. Special subsidies are available which cover 30-80 per cent of the total investment cost of treatment plants and also modifications to manufacturing processes which help reduce pollution.

In France there is no list of permitted additives for foodstuffs apart from lists of colours and anti-oxidants and the foods in which they may be incorporated. Additives can only be used if they are mentioned in the regulations for a particular foodstuff. Labelling regulations with respect to additives seem more strict in France, as emulsifiers, preservatives and anti-oxidants must be declared and named (by their EEC number). It appears that the anti-oxidants BHA and BHT are only permitted in dehydrated products and not in crisps.

* * *

To summarise, the potato processing sector of France has developed very unevenly. In terms of the quantity of potatoes utilised it is the dehydration sector which has predominated with the crisp sector holding a more modest position and the french fry sector being relatively insignificant until fairly recently. The investment plans of a major

french fry manufacturer could change this situation overnight[1]. The manufacturers are largely concentrated into the Picardie region (particularly the Somme Departement) where the production sector is best geared to the requirements of potato processors, although there are some question marks over the availability of suitable quality raw material for certain product utilisations. The uneven development of the industry is largely attributable to consumer resistance to certain kinds of products, although this is slowly being overcome and in particular it seems as though the market for french fries has potential for development. Co-operation amongst potato producers has been encouraged and producer groupings of one kind or another play an important part in supplying the processing sector. Recent attempts to institutionalise contractual relationships between manufacturers and their suppliers highlight the existence of a number of difficulties and represent an interesting approach to coping with some of these stresses. As the quantity of potatoes being utilised for the manufacture of potato products still only approaches 5 per cent of total supplies, and as the industry is so regionally concentrated, the development of the processing sector has left a large part of the French production sector unaffected.

---

1 During the final preparation of this report it was announced that McCain would be opening a factory near Lens (Pas de Calais) for the manufacture of frozen french fries. It has also been announced that the cooperative Beau Marais had been reconstituted as a SICA with 48 per cent of the capital of the business being owned by a member of the Van den Broeke family who run Gastropom in Belgium. SICA Beau Marais will now produce frozen french fries. (Agra Alimentation No.753, 16th May 1980, pps. S+E 14-15).

(iv) THE POTATO PROCESSING INDUSTRY OF THE UNITED KINGDOM

THE POTATO SECTOR

Unlike the development in the potato industries of several other EEC Member States the level of potato production has not declined dramatically since the Second World War. In fact during the period 1955 to 1978 the annual level of production has remained at roughly 6.5 to 7 million tonnes. The different pattern of development largely derives from the relatively insignificant utilisation of potatoes for stockfeed, a result of the operation of successive free trade policies which permitted the importation from world markets of cereals, from which could be made more competitively priced animal feeds. However, because of rapidly rising yields per hectare since the Second World War the potato area has contracted fairly rapidly from 500,000 hectares in 1950 to 214,000 hectares in 1978.

As in other countries, the number of potato producers has declined quite considerably (from 87,000 in 1955 to 33,000 in 1978 in Great Britain) and the average size of potato holding has increased very slightly (from 4 hectares in 1956 to 6 hectares in 1977 in Great Britain), illustrating the increase in the share of the total area grown by farmers with larger potato areas. In 1955 the 3 per cent of producers growing more than 20 hectares of potatoes in Great Britain (England, Scotland and Wales) accounted for 26 per cent of the total area whereas in 1977 6 per cent of Potato Marketing Board (PMB) registered growers in this size category accounted for 40 per cent of the total area. Compared to other Member States the structure of the production sector has comprised much larger individual units.

Potato production is concentrated in those counties to the east of England which have important areas of arable land, such as Lincolnshire, Norfolk, Cambridgeshire, Humberside and North Yorkshire and in the Tayside region of South-east Scotland. There has been a trend towards greater regional concentration although these six areas still only accounted for 45 per cent of the total potato area in Great Britain in 1978.

On the basis of figures collected by the PMB it would appear that the consumption of fresh potatoes in the United Kingdom has contracted, but at a much slower rate than experienced in other EEC countries. However the consumption of potato products has risen quite consistently to maintain the overall levels of potato consumption and, according to the PMB estimates, almost 19 kilograms per person per year (in fresh potato equivalents) were consumed in Great Britain in 1977/8. As a result, the consumption of potatoes (in all forms) per person per year in Great Britain was running at 90 kilograms per person per year in the mid-1950s and in the late 1970s was not very different to that.

In the United Kingdom there has been no industrial utilisation of potatoes and in the past they have only rarely been used for animal feed. Seed production is concentrated mainly in the east of Scotland and Northern Ireland although there is a relatively small English seed sector.

From estimates made by the British Potato Marketing Board (PMB) and the Central Council for Agricultural and Horticultural Co-operation (CCAHC) for the season 1977/8 total available supplies of potatoes in

Great Britain[1] comprised 6.7 million tonnes (including 477,000 tonnes of imported early and ware potatoes and 30,000 tonnes imported seed potatoes). Of these, 59 per cent were sold on the ware market for fresh consumption, 13½ per cent utilised for processing, 9½ per cent used for seed, ½ per cent exported (as seed or ware) and 17½ per cent represented waste, losses and sales for stockfeed and the operations of the PMB.

In Great Britain in 1978 25 per cent of the potato area was planted with varieties classified as earlies, of these the most important were Pentland Javelin, Maris Peer and Ulster Sceptre. Of the maincrop varieties, in 1978 the largest area was planted with Pentland Crown. In that year this high yielding variety comprised 28 per cent of maincrop plantings to be followed by Maris Piper (16 per cent) and Désirée (15 per cent) and then the crisping variety Record (10 per cent) and the quality variety King Edward (10 per cent). Traditionally, domestically-bred white-fleshed varieties have been grown although the rapid growth in popularity of the Dutch-bred variety Désirée (red skinned and yellow fleshed) has indicated that there is relatively little resistance to a yellower flesh colour on the part of consumers.

No background account of the United Kingdom potato sector can be complete without mention of the activities of the PMB which has regulated the potato market of Great Britain since World War II. (Northern Ireland is not included in the British scheme to regulate the potato market). The PMB is a Marketing Board constituted under the Agricultural Marketing Acts of the early 1930s which every producer in Great Britain is under compulsion to support with levies. In consultation with the Ministry of Agriculture, Fisheries and Food, the PMB have operated a scheme which has attempted to control the quantity of potatoes coming on to the market by regulating the area planted, restricting imports and by various interventions on the market. These measures have been applied to ensure that, as near as possible, a pre-determined minimum average price over the season is achieved for main-crop potato growers. The British government has financially assisted the producers' board with its interventions on the market, and also, if the pre-determined price is not achieved, it pays a 'deficiency payment' to producers (in fact, to the Potato Marketing Board for future support arrangements) to compensate for the difference between the actual average market price and the so-called 'guaranteed price'. Undoubtedly the scheme has had a profound effect on the industry and the operation of this system may explain some of the differences in the development of the British potato sector compared to its European partners. The aims of the scheme have been to introduce a minimum price for producers and also to control price instability. The cost of a scheme which has been of benefit to most producers is the inevitable problems which result from the modification of free market forces in the sector. One result of the price maintenance procedures has been that less efficient, badly located producers have been subjected to less economic pressure than they might have been and consequently have continued production when under the operation of free

---

1 A problem in describing the potato sector of the United Kingdom is the absence of a central organisation concerned with the potato industry. The Potato Marketing Board provides wide ranging statistics for Great Britain (England, Scotland and Wales) and consequently these statistics are used when no other convenient data is available from the United Kingdom.

market forces their future in the potato crop may well have been limited. Other common criticisms of the scheme are that it has led to the production of potatoes which are high yielding but not of the best market characteristics (but will still benefit from intervention activities), it has prevented the most economic utilisation of outgrades from the ware crop and it has constrained the development of contracts.

Partly because of her island status, but also because of the operation of the scheme to regulate the market, the United Kingdom has not imported maincrop potatoes on any scale, except during the drought seasons following the 1975 and 1976 summers. An integral part of the market regulation has been the control of imports (and also exports in years of shortage). The power to control imports was lost in April 1979 following a judgement of the European Court of Justice and since that date the British potato industry has been subject to international competition and consequently enters a new era.

The Potato Marketing Board remains in existence but its ability to manipulate the market to increase producers' returns is significantly reduced by the open borders. Despite this, the trappings of market management, such as area quotas and guaranteed prices, still remain and in the place of the intervention system a stabilisation and insurance scheme has been introduced at the instigation of the Potato Marketing Board and the major Farmers' Union. This gives farmers the opportunity to contract with the PMB for 10 per cent of their crop at a prearranged price. If the market price falls below this contract price then additional quantities may be bought by the PMB, but if prices rise farmers could be released from their contractual obligations. The government still participates financially if average market prices go below the guaranteed price and they also assist with intervention costs.

The United Kingdom regularly imports early potatoes on a fairly substantial scale. The imports have traditionally come from Cyprus, Egypt and Spain (including the Canary Islands) and largely comprise United Kingdom varieties which have been grown from UK seed.

Developments in the potato market have brought significant changes in the potato marketing system. As in other EEC countries the development of large scale buyers in the market (such as processors and supermarkets) has resulted in pressure being exerted on the traditional town wholesalers. The larger buyers either make use of direct contracts with growers, individually or organised in groups, or purchase from the collecting (country) wholesalers. Despite the changes the bulk of potatoes bought by consumers are not prepacked (88 per cent in 1977/8 in Great Britain). Although co-operatives are important, the vast bulk of the crop is sold through private wholesalers. Co-operatives have been given financial aids but they have grown only slowly. Another government-sponsored initiative to assist the development of co-operative marketing began in 1979 with new grants being made available and the possibility of further aids if the Ministry of Agriculture's potato programme for England and Wales under EEC Regulation 355/77 is accepted. As a very small portion of the British crop is centrally stored and graded the government's plan is to promote investment in this area.

THE MANUFACTURE OF POTATO PRODUCTS

Historical development

There are some difficulties in discussing the historical development of the potato products sector of the United Kingdom. Firstly basic statistics on the industry only go back to the season 1966/7, and secondly the data only cover Great Britain. This latter deficiency is not serious as Northern Ireland has only a very small potato processing sector.

In a number of respects the development of the potato processing sector of the United Kingdom stands in sharp contrast to that of its neighbours in other EEC countries. The greatest difference is the relatively early growth of the crisp sector. The crisp sector was well established at the beginning of the 1960s, and may well have been using more potatoes then than the crisp industries of most European countries today, although unfortunately no data to describe the early development of the sector exist. The dehydrated potato products sector and french fry sector have only developed on any scale since the 1960s, although, as was learnt at the beginning of this report, the technical breakthrough to produce a reconstitutable mashed potato powder had been developed by the end of the Second World War.

The development of the crisp sector prior to the Second World War has already been described (see Section I). During the 1950s the sector continued to be dominated by a single firm, Smiths, who first began production in the 1920s. The Smiths brand of crisps was very well established and the small greaseproof paper bag with the salt included separately in a little twist of blue waxed paper almost became a national institution. Crisps were still being manufactured by batch frying and it was not until 1958 that the first continuous line was brought into operation (by Walkers). At the end of the 1950s, Smiths held about 80 per cent of a very stagnant market with the remaining 20 per cent of the market being divided amongst numerous smaller local brands produced by organisations operating on a small scale. Consequently, when a large cigarette manufacturing company, Imperial Tobacco, looking to diversify its interests in the face of increasing public concern at the health damage of cigarettes, purchased a small but expanding Scottish crisp manufacturing company in 1959, some changes in the industry seemed inevitable.

With the breaking down of the virtual monopoly held by Smiths during the 1950s the entry of Imperial into the crisp market heralded a period of very intense competition. Selling under the name Golden Wonder (the name of the company which had been taken over), Imperial entered the industry with a ready-salted product, a new form of packaging which prolonged the shelf life, a major investment in a distribution system to control stock rotation at the wide range of outlets selling potato crisps and it backed this up with a major advertising campaign. The company expanded rapidly from a number of regional bases to sell nationally in 1966. By the end of the 1960s the situation in the market had been changed quite dramatically. Golden Wonder had gained a large share of the market and a United States-based company, General Mills, had bought Smiths (which had also acquired another important manufacturer, the Tudor Food Group, in 1961). This takeover occurred in November 1967 and in the same year United Biscuits had entered the market by purchasing Meredith and Drew, a small manufacturer which had been manufacturing crisps since before the Second World War.

The sixties had seen quite a spectacular growth of the sector and from 1961 to 1968 it doubled in size. During this period potato crisps had become available through a wide range of different outlets and in particular benefited from the major changes which were taking place in the food distribution system during those years. Also product innovation resulted in the successful introduction of a wide range of flavours, which were quickly accepted.

In the early 1970s another important change came with the entry into the market of Standard Brands of New York with the purchase of Walkers Crisps. Another development at the beginning of the 1970s was the growth of sales of crisps under the private labels of large food distribution companies of which Marks & Spencer were among the first. Between 1966/7 and 1973/4 the quantity of potatoes manufactured by the crisp sector rose from 323,000 tonnes to 480,000 tonnes (see Table UK1). However the size of the industry fell to roughly 400,000 tonnes during 1975/6 to 1977/8, partly as a result of the imposition of Value Added Tax and the growth of the market for savoury snacks other than crisps and sticks, but also because of the problems obtaining raw material during the two years of drought, 1975/6 and 1976/7.

One major feature of the development of this sector has been the very strong regional development of certain brands. For example, Walkers, who originally began making crisps in the late 1940s as a subsidiary enterprise to a pork butcher's business, have a very strong position in the Midlands region. Tudor, one of the subsidiary brands of the Smiths Food Group, is well established in north-eastern England and Golden Wonder have a strong following in Scotland where the company originally began production.

The development of the market for crisps cannot be separated from the development of sales of other savoury snacks based either upon dehydrated potato or maize flour. Smiths produced their first savoury snack in 1964 although the market did not expand rapidly until the 1970s. During the 1970s a bewildering number of products appeared on the market. According to the Economist Intelligence Unit, in 1977 the market was about one-third the size of the crisp market in value terms and growing at a much faster rate. In 1973 514 million packets were being sold and by 1977 this had risen to 1,075 million packets. The principal manufacturers are the same as those involved in the manufacture of crisps. To underline the overlap between the crisp and the savoury snack market, in July 1977 United Biscuits launched a new product, Discos, which is sold as a reconstituted crisp. Another large company with interests in manufacturing dehydrated potato granules entered the snack market in 1978. This company, Cadburys, introduced Stackers, another reconstituted crisp but this time based upon the formula adopted by Proctor and Gamble for their introduction of Pringles on the North American market in the early 1970s. This product is aimed more at adults and is expensively packaged in tubes to maintain freshness. Cadbury import this product from the United States. Smiths are also in the reconstituted crisp market with Square Crisps.

The early history of the United Kingdom dehydrated potato sector has already been outlined. Despite the early developments in this sector there was very little growth until the late 1960s and by 1966/7 only 32,000 tonnes of potatoes were being manufactured, less than in West Germany, the Netherlands and France. One reason for this was a very strong consumer resistance to a product which they associated with difficult years following the Second World War and also because the demand for convenience foods such

Table UK1 Quantities of potatoes used for processing potato products in Great Britain ('000 tonnes)

calendar year	dehydrated products	french fries [a]	crisps	canned whole	canned diced	total
1966/7	32	25	323	17	11	408
1967/8	40	58	344	24	13	479
1968/9	41	88	370	22	15	521
1969/70	80	138	325	25	16	584
1970/1	93	189	347	27	17	673
1971/2	81	209	386	34	17	727
1972/3	95	281	406	25	17	824
1973/4	127	394	480	28	16	1045
1974/5	149	364	460	31	17	1021
1975/6	207	387	396	21	15	1026
1976/7	156	343	397	28	n.a.	(924)
1977/8	98	377	400	15	n.a.	(890)
1978/9	167	570	470	9	n.a.	(1216)

a from 1974/5 on, other fried non-snack products are included.

n.a. not available

Source: PMB.

as instant mashed potato had not developed. In 1963 Dornay Foods (a subsidiary of Mars) launched a potato granule on the market after successful test marketing in earlier years. At this time Reckitt and Colman were also producing granules from a Northern Ireland factory and a small quantity of flake was being produced by Swel (Rank Hovis McDougall). Three years later Cadbury entered the market with another granule product. Reckitt and Colman left the sector during the mid-1960s. In 1968 Dornay produced the first agglomerate product (Wondermash), a move which was followed by Cadbury a couple of years later. The french fry manufacturers McCain entered this market in the mid-1970s when they began to produce potato flakes at one of their factories. Granules have always been the most important product on the British market and even today flakes take a much smaller share of the market. An important factor affecting the development of the dehydrated potato sector in the United Kingdom has been the influence of imports which have been an important source of competition since the mid-1960s. There is only one manufacturer of dehydrated potato pieces (Swel, RHM) a company which has been involved in producing this product since the Second World War.

In the United Kingdom the development of the french fry and other fried non-snack potato products sector has been largely confined to frozen products. Very few organisations have manufactured fresh or chilled french fries, mainly because caterers and housewives in the United Kingdom have traditionally fried french fries only once. In continental Europe, where french fries are traditionally twice fried, there was a strong demand for a first-frying service from caterers and this had been the first step in the development of the french fry sector in the Netherlands and West Germany. Consequently, unlike in other countries, the french fry sector in the United Kingdom began more as an off-shoot of the rapidly developing frozen food sector rather than as a newly emerging separate industry.

The manufacture of quick frozen foods has been one of the fastest growing areas of the United Kingdom food manufacturing industry since the Second World War. Up until 1956 sales of frozen goods were relatively small but with the development of a frozen food distribution system in the later years of the 1950s and the beginning of the 1960s the sector grew rapidly. With this growth came increasing concentration of ownership of the sector and in particular three groups, Findus, Imperial Group and Birds Eye developed, to hold very important positions in the industry. In the context of this general development of the frozen food industry the manufacture of french fries emerged. Initially, much of the processing was centred around the fish freezing enterprises based at the principal fishing towns located on the east coast of the country and the major general freezing and distribution companies had an important interest in the sector. In the mid-1960s the Frozen Food Yearbook suggested that there were 23 companies involved in the french fry sector, many of them small, and many producing potatoes as a side-line to fish, vegetables or fruit. At this stage little more than 25,000 tonnes of potatoes were being processed and no individual organisation had a substantial throughput, although several companies were under joint ownership. Of the large multi-product freezing companies, the Ross Group (later Imperial Foods) was the most important and it has been estimated that they had a 30 per cent share of the french fry market. Later in the 1960s McCain (initially selling Canadian products) and Potato and Allied Services (since 1970 owned by Christian Salveson) started producing frozen french fries. In contrast to many of the other organisations producing french fries at this time, these two companies specialised in potato products and during the period of rapid growth in the french fry market at the end of the 1960s and beginning of the 1970s they became the

largest french fry manufacturers. The rate of development during these years was very rapid with 394,000 tonnes of potatoes being processed in 1973/4, almost sixteen times the quantity being used seven years earlier. Growth since 1973/4 has been less consistent and in particular the output of the sector was seriously affected by the drought seasons of 1975/6 and 1976/7. In the short history of the french fry sector there have been quite a number of examples of smaller companies who have entered the sector only to leave it fairly soon afterwards, although it appears that recently the number of smaller companies appears to have stabilised.

The canning of potatoes has been carried out mainly by companies already involved in canning fruit and vegetables. As can be seen in Table UK1, the output from this sector was relatively stable between the mid-1960s and mid-1970s but since that date has contracted. The canning of diced potatoes (sold as potato salad or in soups) is usually distinguished from canned whole potatoes. There are many organisations involved in canning whole potatoes and no organisation processes very large quantities. The canning of diced potatoes is mainly conducted by two large canning companies which have traditionally canned a wide range of grocery goods. There is very little information on when the canning of potatoes began in the United Kingdom, although it is suspected that many of the established fruit and vegetable canners have been including potatoes in their range of products since the last World War.

In addition to these major groups of products, few other processed potato products have been introduced into the United Kingdom. However, potatoes are used to prepare a number of popular dishes and these represent important products for some food processors, e.g. Cornish pasties and shepherds or cottage pies. A number of attempts to introduce vacuum packed sterilised potatoes in the United Kingdom have been made without any success.

In summary, in comparison to other European countries, the United Kingdom potato processing industry is remarkable for the relatively early growth of its crisp manufacturing sector and the very rapid development of this sector through the 1960s. The french fry sector has not developed rapidly until fairly recently and it still remains a relatively new industry. The main growth of the dehydrated potato sector came during the 1960s although the early expectations of growth in the sector have never been fulfilled largely because of competition from imports.

The industry today: utilisation of potatoes, structure and location

Potato Marketing Board statistics suggest that 890,000 tonnes of potato products were manufactured in the United Kingdom in 1977/8. However, it is readily acknowledged that this figure may be an underestimate because of the difficulty in estimating the quantity of potatoes processed into a number of miscellaneous products such as Cornish pasties and shepherds pies. In addition, one category of products, canned dice, are no longer included in these statistics. It is estimated, on the basis of the quantity of potatoes manufactured in previous years, that roughly 15,000 tonnes of canned dice are processed annually, bringing the total quantity processed for the main categories of potato products to 1,231,000 tonnes in 1978/9.

In terms of the quantity of potatoes processed, the french fry sector is the most important sector of the potato processing industry, overtaking the crisp sector for the first time in 1978/9. In that season it accounted for 46 per cent of the potatoes manufactured into processed products in

Great Britain. The industry is dominated by two large firms, McCain and Potato and Allied Services. Trade estimates suggest that these two companies account for 60-70 per cent of the fresh fries and other fried non-snack products appearing on the UK market. McCain is understood to be the largest single product in the United Kingdom. In addition to these two major companies there are a number of medium size companies which include Birds Eye (Unilever), Union Cold Storage Company (Union International Ltd.), Jus-Rol, Witch Chips (West Cumberland Farmers), Shieldness Produce, Esk Food, Garden Isle (Allied Breweries), Everest Frozen Foods, Garden King and Benedict. Of these, only one company, Shieldness, is producing fresh or chilled products. Some of the smaller companies are only servicing regional markets. In addition to these, two companies produce fresh fries in Northern Ireland on a modest scale. One of these companies (Ballymoney Foods) is owned by a trust and run by the Department of Agriculture for Northern Ireland.

Although no longer the largest user of potatoes, the crisp sector still remains very important. In 1978/9 38 per cent of the potatoes destined for potato processing went to this sector. It has been estimated by the Economist Intelligence Unit that in 1977 the four major companies, Smiths Food Group (who were purchased by Associated Biscuit Manufacturers in 1978), Golden Wonder (the Imperial Group), Walkers (Standard Brands) and United Biscuits accounted for 80 per cent of the sales in this market under their own brand names. In addition they will be supplying some of the crisps sold under private labels which accounted for another 10 per cent of the market. Other manufacturers of crisps include Garfield Weston Group (selling the brand XL), Rileys (selling the brands Riley and Murphy), Tayto (in Northern Ireland) and Seabrooks; a small factory operated by the David Johnson Group is also expected to begin production in 1979.

The dehydrated potato sector accounted for 14 per cent of the potatoes processed in the United Kingdom in 1978/9. There are two companies producing potato granules, Dornay Foods (Mars, USA) and Cadbury Typhoo. These two companies are understood to share fairly evenly that part of the granule market supplied from UK manufacturers. In addition, the french fry manufacturers, McCain, produce potato flake and Swel (Rank Hovis McDougall) dehydrated potato pieces.

Canners of potatoes only accounted for 2 per cent of the total quantity of potatoes processed in 1978/9. One company, Heinz, dominates the production of canned dice in the form of potato salad (diced potatoes in salad cream). The canning of whole potatoes is carried out by a large number of organisations most of whom manufacture only relatively small quantities. Most of these are also fruit and vegetable canners although Mars/Dornay, the manufacturers of potato granules, also can potatoes. Most of the canners are owned by large food manufacturing companies. They include Smedley - HP Foods (Imperial Group), Tyne Brand Products (Distillers), T.W. Beach & Sons (Cavenham), Lockwood Foods, Anglia Canners (Garfield Weston Group), Lincolnshire Canners (Del Monte Corporation of the United States), Newforge (Fitch Lovell), TKM Foods, the Co-operative Wholesale Society, Stratford-upon-Avon Canners (Distillers), Cadbury Typhoo and Cross and Blackwell (Nestlé, Switzerland).

Like the Dutch potato processing sector one feature of the United Kingdom industry is the strong representation of multi-national companies with headquarters outside of the United Kingdom. In the crisp sector the two United States corporations, Standard Brands and General Mills, have

held major interests (although the latter sold its interests to a UK-based organisation in 1978). The Canada-based McCain holds an important position in the french fry sector as does the United States-based company Mars in the dehydration sector, and several of the organisations involved in the canning industry are also multi-nationals.

Agricultural co-operatives are not very heavily involved in the processing of potato products. The largest co-operative manufacturer of potato products is West Cumberland Farmers (Witch Chips). This co-operative is located in the north-west of England and has wide agricultural interests including potato wholesaling. In 1974 it took control of a french fry factory in North Yorkshire. Another major co-operative with substantial interests in the merchanting of potatoes is Anglian Produce based in East Anglia. This co-operative has recently become involved in the frozen food sector and it is understood it will include a small quantity of frozen potato products in its produce range. Another co-operative Fife Growers based in eastern Scotland is also understood to manufacture some potato products amongst its range of frozen vegetables.

Potato processing factories are located throughout the United Kingdom (see Map 4[1]) although there is a tendency for factories to be located to the east of the country where it is easier to get supplies of raw material. Access to raw material has been a factor of primary importance in determining the general area of location but other factors have played their part in influencing the specific location of a factory. Of great influence in recent years has been the availability of government assistance. Many of the factories producing potato products have been established during the 1960s and 1970s, years when a number of government measures have been introduced to attempt to develop certain regions and to overcome the problems of unemployment. Good communications have also been an important consideration and particularly access to motorways or good trunk roads. A number of other factors have also proved to be important such as the availability of good and cheap water supplies; access to effluent disposal facilities (in this respect, several organisations have mentioned that plants located close to the coast have fewer problems with waste disposal); and labour supply. Essentially the location decision is a compromise with one factor being offset against another. For example certain parts of East Anglia are ideal in terms of raw material supply but communications can be difficult because of the absence of good motorways in the region.

Circumstances affecting location decisions change over time and consequently one finds that a number of the organisations which have been in potato processing for a long period have taken location decisions based on factors which are now far less important. This is particularly true of some of the companies operating in the crisp industry, and particularly Smiths whose original location decisions were made prior to the 1960s. The same also applies to some of the canning organisations, some of which came into existence after the First World War located in the old market garden areas on a relatively small unit scale.

The Smiths group began production in the early 1920s and many of the original location decisions were based upon the need to be near the coast and close to major seaside towns in order to service the major summer market

---

1 See Appendix 1.

from holidaymakers at the traditional seaside resorts. Smiths today manufacture crisps at Portsmouth (south coast), Stockport (north west coast), Yarmouth (east coast) and Peterlee (Durham), the latter being the location of the Tudor food products factory which was taken over by Smiths in the early 1960s. Smiths also have factories producing snack products in London, Swansea, Lincoln and Fleetwood, and prepare and pack nuts in Cardiff and Corby. Golden Wonder and United Biscuits came into this sector much later and consequently they were able to make their location decision on the basis of factors which are more relevant today. Golden Wonder have factories at Widnes (Cheshire), Corby (Northamptonshire) and Broxburn (near Edinburgh). Government grants have been particularly important in the siting of these three locations but the availability of raw material has also been taken into account. In addition Golden Wonder have two other factories producing savoury snacks and another factory (the original Golden Wonder crisp factory) is now used for preparing and packing nuts. Government aids were also very important for United Biscuits who sited factories at Teeside and Humberside, although another important factor was the availability of an important potato area in North Yorkshire which could service both of these factories. The other major crisp manufacturer, Walkers Crisps, has two factories near Leicester. The company is therefore located right in the middle of its major market area although road communications in the Midlands are such that the company has relatively easy access to important production areas further east.

A development grant and the proximity of a suitable quantity of good quality potatoes appear to have been the major factors affecting the location of the Cadbury dehydration factory in Catterick, North Yorkshire. The Yorkshire area was particularly suitable because there appeared to be a surplus of potatoes in the area and because some Yorkshire soils produced a relatively unattractive potato which could not compete on the Midlands ware potato markets, but which was suitable for dehydration. Plenty of labour was available in the area and road communications were good. The location of the Dornay dehydration factory was also strongly influenced by the need to be close to the production area and by the availability of development area grants. Originally Mars had begun test production of their potato products (including, at that time, a snack product made from raw potato) at Slough (Berkshire) but in 1963 they decided to move production to East Anglia in order to be closer to an important potato production area.

Both of the principal french fry manufacturers are located close to major potato production areas. McCain has two factories, the first of which was located in Scarborough (North Yorkshire). Again government assistance was an important factor, but, in addition, Scarborough had public facilities which could cope with the discharge of effluent from the factory and this proved an important factor. Water supply was available fairly cheaply from wells and labour supply was perfectly adequate throughout most of the year as the major industry in the area (i.e. tourism) had a seasonal demand for labour. McCain's choice of Scarborough meant that there were several major potato processing factories, Cadburys, United Biscuits (two factories), Tudor, Witch Chips and McCain, competing for supplies in the North Yorkshire production area.

McCain's second factory was built near Peterborough in 1976. In this area there are relatively few problems in locating raw material; however water supplies were limited and the disposal of effluent was a more difficult problem. As was indicated earlier in the description of the development of the french fry sector, the industry is very closely associated with

the general development of the frozen food sector. Consequently a number of manufacturers have been located in the east coast fishing towns. However, of these, only the Birds Eye factory in Great Yarmouth was still producing potato products in 1979 and there are plans for it to close. Most of the other manufacturers are located inland (although not necessarily very far from the coast), usually within important potato production areas.

Most of the canning factories developed after the First World War in the old market garden areas. None of these companies process large quantities of potatoes and consequently their location has largely been influenced by the availability of other vegetables. The most important area for canning is Holland, Lincolnshire and the Kings Lynn area of Norfolk.

The potato marketing system and raw material supplies

When considering the raw material supply for the potato processing sector it must always be recognised that the potato production sector of Great Britain has been subject to regulation through the operations of the Potato Marketing Board. In one way or another these arrangements have had an important, though often indirect effect on the way in which potato processors operate. A number of the processors commented upon the indirect effects of the operations of the Potato Marketing Board. These included the problems of getting producers to consider fixed price contracts, the difficulties in obtaining supplies of the necessary varieties, and the problems of purchasing certain outgrades. In addition the market intervention activities of the Potato Marketing Board have meant that often the UK processors have been purchasing potatoes at prices which are much higher than their competitors in Europe and consequently they are subject to strong competition on their home and export markets. There also appears to be a general feeling that government policy towards the potato industry has been directed towards producer interests and that processors need to be involved much more as they represent a very important sector of the industry.

It is important to consider the raw material procurement policies of the main sectors separately because the problems faced are specific to each sector.

The crisp sector is generally less affected by the activities of the Potato Marketing Board than any of the other potato processing sectors. As noted in an earlier section the major reason for this is the need to grow a specific variety for manufacturing into crisps. The variety which is grown, Record, is preferred because of its high dry matter content, low sugars and yellow flesh. It also stores very well and responds well to conditioning. It has consistently out-performed other varieties in the United Kingdom and at the present time there seems to be no serious competitor. Despite this it should be added that many of the crisp manufacturers are keen to identify new varieties largely to overcome the major problems of Record, its relatively low yield, generally low disease resistance and the lack of value on other potato markets. Other varieties which may be used include Maris Piper, Pentland Ivory and King Edward among the maincrop varieties and English Bintje, Home Guard and Red Craigs Royal amongst the second earlies. Imported varieties (principally Arran Banner) are also used to fill the summer gap and also Bintje has been imported early in the season.

The problems of growing Record underline the need for close relationship between manufacturers and their suppliers and this is a feature of the raw material procurement systems adopted by many crispers. As Record cannot

be sold successfully on the ware market the only way that the crisp manufacturers can obtain their raw material supplies is by contracting from growers often using merchants as intermediaries. In order to give themselves some flexibility a relatively small proportion of purchases will be made at market prices, but it is usual (although not always the case) that these purchases take place during the summer and harvest period (free market purchases later in the season leaves the manufacturer rather more vulnerable to inadequate storage practice on the part of those who have been holding potatoes).

Companies vary in their dependence upon merchants. Some contract exclusively with merchants and leave the merchants with the responsibility of arranging supplies from growers. Others have developed fairly close direct links with contracting growers for a large part of their raw material requirement. The advantage of using merchants is the greater ease of procurement, the merchant will shoulder many of the problems of the manufacturer in terms of dealing with the grower and, most important, arranging delivery. The manufacturer does not have to employ staff to carry out these expensive functions. The disadvantage of purchasing through merchants is the lack of direct contact with growers (although this need not necessarily be the case), and therefore less control over their husbandry techniques and storage practices. It is interesting to note that two of the major crisp manufacturing companies purchase supplies through their own merchanting organisations. United Biscuits (Agriculture) acts as a potato merchanting organisation on behalf of United Biscuits, and procures potatoes directly from growers. Golden Wonder use another subsidiary of the Imperial Group (Ross Produce) to procure their supplies from producers or co-operatives. Smiths (including Tudor), Golden Wonder and United Biscuits buy a large proportion of their supplies directly from growers, whereas Walkers and Rileys have opted for purchasing most of their potatoes from merchants (although some of these are also large scale growers).

Different policies have been found with respect to storage. Some companies, e.g. Golden Wonder, have opted for substantial company owned and controlled storage facilities giving close control of the storage regime adopted. Other companies have taken a compromise position, storing some potatoes in their own stores and others in leased stores over which they maintain constant supervision (e.g. United Biscuits). To erect and run stores is expensive and for processors it is a trade-off between this expense and the advantages of having even greater control over storage procedures. Generally most of those using on-farm storage seem to have been reasonably happy with the quality of potatoes they receive, although all would welcome additional investment in specialist farm stores. Over the years the storage skills of farmers have been upgraded and those farmers who are unable to store good quality potatoes for crisping have been dropped.

The number of growers supplying some crisp manufacturers can be quite small, in fact Smiths procure a significant share of its raw material from as few as 50 large-scale growers of potatoes. All the major crisp companies will be drawing supplies from quite a wide area although wherever possible supplies are drawn from the locality of the factory. For example Golden Wonder and Smiths both draw supplies from Cheshire and Shropshire to supply their north-western factories and Smiths would be drawing upon Hampshire farms for its factory in that county. Factories which are located in the Midlands are within easy reach of raw material from the east of England.

A major problem with using the variety Record is the difficulty of selling those potatoes which are not required on the ware market. Most crisp manufacturers buy on the basis of quantity contracts although prices paid would reflect the difficulty of disposing of those potatoes which are not required. However, because crisp manufacturers buy a certain proportion of their supplies on the free market a number of farmers will grow Record on a speculative basis. Merchants play a major part in placing these supplies and also those Records which are not suitable for crisp manufacture. One company has initiated a contracting system which pays the producer a price which is related to yield. An estimate is made of the production cost per hectare and an amount is added to this to give a reasonable return to the producer bearing in mind market factors. Then on the basis of test digs this sum is divided by the usable yield to give the contract price per tonne.

French fry and dehydrated product manufacturers are in a much more flexible position because they can utilise many of the varieties which are commonly sold on the ware potato market in the United Kingdom. One variety in particular, Pentland Dell, appears to meet the french fry manufacturers' requirements rather better than any other variety freely available in the United Kingdom. Some french fry manufacturers have commented that growers are often reluctant to risk growing this variety as it presents them with a greater challenge than varieties such as Pentland Crown. Pentland Crown is a variety which is much more easy to grow and produces a very high yield; it is however a variety which has less appeal to consumers or manufacturers. A common criticism of the system which has been used to regulate the British potato market is that it has encouraged producers to grow high yielding varieties (which unfortunately are often associated with less desirable market characteristics) because these varieties could always be sold for a reasonable price because of the intervention activities necessary to maintain the so-called guaranteed price. However, with care taken in the husbandry, Pentland Dell can be grown very successfully. As Pentland Dell is not widely grown (in fact its area has declined in recent years), the manufacturers have had to offer premium priced contracts to ensure that the variety is available.

Other varieties used by the manufacturers of french fries would be Maris Piper, Pentland Hawk, Pentland Ivory, Pentland Squire, occasionally Pentland Crown, Désirée, UK Bintje and Wilja. The procuring of potatoes during the summer period has involved importing supplies and purchasing those UK early potatoes which have been found to be suitable. Many of the smaller frozen french fry factories are also freezing other vegetables and consequently during the summer period they simply close down their french fry line. For the specialist UK frozen french fry manufacturer the summer period is not a serious problem, particularly as in recent years new maincrop varieties mature earlier and imports from Mediterranean countries are freeing domestically produced earlies for the processing sector. In addition, some manufacturers claim that the availability of better technology within the factory has meant that the manufacturers are able to handle potatoes which ten years ago they might have considered as unacceptable.

Some major British processors, particularly those who are processing french fries, have experienced some difficulty in obtaining raw material of suitable quality within the United Kingdom and as a result they have naturally cast their eyes to other possible sources. In the past the possibility of importing maincrop supplies from other countries has been very severely restricted by the operation of the system of market regulation in operation in Great Britain. With the freeing of trade following a

judgement in the European Court of Justice in April 1979 manufacturers for the first time have had an opportunity to import supplies. Some manufacturers have made no secret of their willingness to do this should the prices prove to be attractive in view of the quality of the UK crop. It remains to be seen what kind of reorientation will take place in the procurement systems adopted by the french fry manufacturers but the threat of imports represents a major challenge to the British production sector. However, the quantity of potatoes which is likely to come into the United Kingdom on a regular basis seems likely to be fairly small because transport costs will always be important and wherever possible the french fry sector (and the crisp sector) must establish regular raw material supplies from a domestic base to operate on a long-term viable basis.

The principal french fry manufacturers use pre-season contracts to procure a fairly large proportion of their requirements. The exact proportion purchased in such a way will vary from year to year depending on prospective product and raw material market situations. To ensure that they get at least a basic quantity to maintain the throughput of their factories most of the major french fry manufacturers are likely to procure at least 40-50 per cent of their supplies on contracts. In years when they are more confident of future developments they may push this proportion higher but they are unlikely to go much above 70 per cent because of the associated risks. Some of the major companies have found it difficult to get potato producers to contract with them and they have often associated with the operation of the official market regulation scheme. With the operation of this scheme a potato grower can never have a total disaster and consequently he is not looking to spread his risks by taking contracts with processors. However, as the french fry industry has developed the processors have found it easier to obtain contracted supplies because they have been able to establish links with a core of reliable growers who are willing to operate on a contractual basis.

As in many other countries the drought years of 1975/6 and 1976/7 put extreme pressure on contractual arrangements and there were many instances of contracts being broken and consequently relationships between processors and producers were soured. To a certain extent this set-back attempts to establish a contractual procurement system but on the other hand it gave the manufacturers the opportunity to establish which of their suppliers had the mentality to participate in a system which depends upon the long-term complement of interest between manufacturer and producer.

There are a number of different contract options being used in the french fry sector, some of which offer fixed price contracts and others participation contracts which relate the price to developments in the ware market.

The raw material procurement policies of the dehydration sector are very different in principle to those of the other two major processing sectors. Historically the dehydrating companies have purchased a very large proportion of their supplies on fixed price contracts in a very similar manner to that adopted by the french fry sector. In the early days only very top quality King Edward potatoes were used and more recently Pentland Dell, Pentland Crown and Maris Piper were important, although it was recognised that no UK variety was absolutely ideal for dehydration. The contractual procurement system adopted in the past had a fairly high specification and at one stage one of the companies involved in this sector even had a contract which included a price which was related to dry matter

content. However, the situation has changed quite dramatically in recent years, largely as a result of the strengthening of competition from imports, particularly from the United States and Canada. In order to compete the industry made a number of adjustments which had important implications on its procurement policy. The main change has been the modification of the equipment and techniques used in the factory to enable potatoes of a different specification to be utilised. These potatoes include a fraction of the crop which might be visually unattractive but which are inherently sound, potatoes which previously would have been considered unsuitable for processing and would not have been sold on the ware market. Such raw material is not available throughout the season and consequently some high specification potatoes are bought on contract for storage to provide continuity. Because of reasons of confidentiality it is not possible to expand on the precise methods of procurement adopted by the two major dehydrators. Suffice it to say that both granule manufacturers appear to have been successful in identifying suitable sources of raw material which can be used to produce a satisfactory product. Whilst local supplies would be preferred it is often necessary for the dehydrators to cast their net fairly widely for adequate quantities of the appropriate raw material although transport costs operate as a real constraint.

The canners are normally purchasing potatoes which are readily available on the ware market, but in some circumstances it is necessary to procure by means of contracts in order to ensure that raw material is available. Up until 1971/2 a large proportion of the raw material used for canning of new whole potatoes was imported either from Jersey or from Egypt. The main variety used at that stage was the Jersey Royal. Imports are still an important source of supply but domestically produced potatoes are now much more widely used. The principal domestic varieties used for the canning of whole new potatoes are Maris Peer and King Edward. The canning of maincrop potatoes is mainly in the form of potato dice and consequently large tubers with low specific gravity are required. Where maincrop potatoes are required for canning whole potatoes, a small-sized low specific gravity potato is specified. Some canners have found it difficult to obtain suitable maincrop raw material from domestic sources and have imported from the Netherlands.

There is a wide range of conditions included in contracts and it is difficult to generalise. In the french fry sector these are likely to include minimum standards of dry matter content, sugar content and levels of damage. In order to encourage production of better quality potatoes some organisations offer bonuses and discounts depending upon whether certain quality levels are attained. In the crisp sector dry matter content is seldom specified as most of the processors are content to rely on the variety Record producing adequate levels. However most crisp manufacturers recognise that growers can influence the levels of dry matter and would therefore attempt to make them aware of just how this can be done without using price incentives. Because blanching is widely used by most crisp manufacturers in the United Kingdom the levels of sugar are less critical than they used to be although sugars still remain an issue of serious concern. Invariably tests on reducing sugar levels or frying tests (often both) will be carried out to assess if the potatoes are acceptable for the manufacture of crisps. However, the sector has suffered because of the absence of a quick and reliable means of quantifying reducing sugar levels, and consequently some of the procedures used to assess whether a consignment of potatoes is acceptable have been open to criticism. The manufacturers of dehydrated products in the United Kingdom are less likely to specify minimum

11)

standards in terms of dry matter content or sugar levels because of the kind of raw material they are purchasing today. However they do have to be very careful about sugars because some of their output will be utilised by the crisp manufacturers for the manufacture of snack products. Rather than being highly specific in terms of reducing sugars throughout the year, they may well process for these buyers from specially designated low sugar stocks which they may store themselves or have stored on their behalf.

The PMB ware standard is often quoted as being the basis of quality standards in terms of damage and defects although several processors might take a fairly flexible view in this respect. As with sugars, any flexibility in assessing acceptability can lead to problems, as it is difficult for farmers to understand why a load may be accepted one week and rejected the next when they are from the same store.

Various attempts have been made to introduce central negotiating and bargaining of contracts on behalf of growers who are supplying processing organisations. A growers' organisation funded by voluntary levy (the Processed Vegetable Growers Association Limited, PVGA) specialises in negotiating contracts with processors on behalf of growers. This organisation developed to meet the requirements of growers providing vegetables for freezing and canning organisations but also has attempted to work in the potato sector. In the potato processing sector they have only really had impact in the manufacture of crisps, for the level of purchases on the free market in the other sectors make effective central organisation of growers ineffective. In the crisp sector a number of consultative groups have been formed on the initiative of the manufacturers in order to maintain a high level of liaison between growers and processors. In some cases these liaison groups are restricted to considering technical matters and the handling of contract negotiation is left to another specialised committee which will be serviced by PVGA. The consultative committees are serviced with data on costs of production and the general market situation to help them to negotiate terms for the following year. However, it should be noted that not all crisp manufacturers negotiate with PVGA-serviced committees.

Contracts in the french fry sector are negotiated separately with each individual grower. This usually involves the french fry company establishing quantities required and contract prices it can afford to pay in advance of the season and then sending these offers of contract to producers. The fieldsmen of the major companies play an important part in the administration of these contracts and also might be used to procure potatoes on a spot basis in addition to their everyday technical work.

As we have seen the importing of potatoes to service the potato products industry of the United Kingdom has been relatively insignificant, except in years of very serious shortages such as 1975/6 and 1976/7. In view of the ban on the import of maincrop potatoes this is hardly surprising and the main role of imports has been to fill the gap between the old crop and the new harvest. However, in the new circumstances of open borders there are greater opportunities for imported raw material and one of the largest french fry manufacturers has publicly stated that the quality of British raw material must improve or else he will be forced to import supplies. In addition, the crisp manufacturers are known to be interested in imported supplies early in the season when the dry matter content of domestic supplies is still low. The traditional importing of early potatoes for canning when domestic varieties are not available is less common today but canners seem likely to continue to be interested in importing low dry

matter content maincrop potatoes which are less readily available from domestic producers. In their current situation it is most unlikely that the manufacturers of dehydrated products will find it attractive to import supplies of raw material on a regular basis.

External trade

The domestic production of potato products in the United Kingdom is supplemented by imports. As can be seen in Table UK2, the quantity of potato products imported into the United Kingdom has been fairly stable, apart from the two years of short supply on the ware potato market when very large quantities of fried non-snack products and dehydrated and canned potatoes were imported. Apart from these two years imported supplies have only been substantial in the dehydrated and canned potato markets. On the basis of calculations made by the PMB and the CCAHC it has been estimated by the author that when expressed in raw potato equivalents, roughly 12 per cent of the products becoming available in Great Britain in 1977/8 were being imported. (This figure is calculated on the basis of imports of processed products into the United Kingdom and consequently will be a slight overestimate of the figure for Great Britain. Unfortunately no estimate is available for the entire United Kingdom).

As Table UK2 shows, the dehydrated potato imports account for a large share of the incoming trade. Imported dehydrated products account for a considerable (though variable) proportion of the product available on the British market (25 per cent in 1974/5 and 50 per cent in 1977/8) although the same qualification about the coverage of the statistics should be entered here and it should also be remembered that dehydrated products can be stored over a fairly long period of time and consequently not all production or imports need necessarily move into consumption in the year which they become available in the United Kingdom. It is this high level of import penetration which has prevented the dehydration sector of the United Kingdom from developing as rapidly as was expected when it first began to expand on an industrial scale during the 1960s. The most important sources of supply of imported potato granule and flake have been Canada and the United States although the Netherlands and Ireland have been regular suppliers of modest quantities and West Germany and France much smaller quantities. Imported dehydrated potato pieces are also important and represent a large share of the domestic market. For example, in 1978 1,800 tonnes of dehydrated potatoes were imported which is estimated to be more than half the size of that particular market. Imports have regularly come from West Germany, the Netherlands, Ireland and the United States, although Irish production has now ceased.

The imports of fried non-snack products has been very irregular depending upon market prices in different countries of the EEC. In 1975/6 and 1976/7 large quantities were imported but in the season 1977/8 the imports of this class of product represented roughly 5 per cent of the total market (again with the same qualifications as above). The major supplier has been the Netherlands.

The United Kingdom regularly imports canned whole potatoes. It is estimated that in 1977/8 approximately one-third of the supplies available on the British market were imported. Over the years the principal suppliers have been Belgium/Luxembourg, Italy, Ireland and West Germany.

Table UK2 Imports of potato products into the United Kingdom by product type ('000 tonnes)

	dehydrated	crisps	frozen fried non-snack products	canned	total
1968/9	16	-	9	8	33
1969/70	18	1	5	10	34
1970/1	16	1	6	14	37
1971/2	12	1	-	13	26
1972/3	11	1	1	11	24
1973/4	17	1	-	8	26
1974/5	7	+	3	8	18
1975/6	42	+	36	14	92
1976/7	45	1	45	25	115
1977/8	13	1	11	7	32

+ = less than 0.5

Source: PMB.

As might be expected, because of the cost of transportation into the United Kingdom, the level of crisp imports is relatively insignificant. Two crisp manufacturers based in other countries have attempted to establish regular sales in Great Britain, one being the French co-operative Vico and the other an Irish crisp company which sells through a subsidiary of Irish Dairy Board, Adams Foods. Because of the very high transport costs incurred and the very difficult distribution task, these organisations only take a very small share of the British market. In addition to this the two major crisp manufacturers in Ireland both export into Northern Ireland.

The United Kingdom is a regular exporter of dehydrated potato products (granules), frozen french fries and crisps. Exports of potato granules rarely exceed 3,000 tonnes and the major regular markets are Ireland and Denmark although smaller quantities are sold to all other members of the EEC. The export of french fries (18,000 tonnes in 1978) is largely to France, the Netherlands and Ireland but also several other European markets are serviced and new markets are being developed in the Middle East. Crisp exports (1,000 tonnes in 1978) are mainly to Ireland but a long list of other countries take small quantities.

Demand

According to calculations made on the basis of statistics provided by the PMB it is estimated that in 1977/8 consumption of potato products was of the order of 19 kg per person per year in fresh potato equivalents. This figure should be treated with a little caution because of the problems in calculating such a figure on the basis of estimates of apparent consumption. Of this, consumption of crisps represents roughly 7.5 kg per person per year, consumption of frozen french fries and other fried non-snack products 7.5 kg, dehydrated potato products 3.5 kg and canned products 0.5 kg.

The level of consumption of crisps in the United Kingdom is much higher than in any other country in the EEC although it still lags a little way behind consumption in the United States. According to data presented in an Economist Intelligence Unit report, over one-third of total crisp consumption was accounted for by children under 13 and over 15 per cent of all purchases are made by this group. There is slightly higher consumption in the summer which may be accounted for by higher levels of outdoor eating. There is also an increase in demand for larger packs around Christmas. Despite the wide range of flavours available on the market, plain or ready salted flavours still account for almost 40 per cent of the market with cheese and onion and salt and vinegar being the two next important varieties, each with between 15 and 20 per cent of the market. Beef, bacon and chicken flavours follow these, but that still leaves a fairly large market share for a wide range of other flavours such as roast lamb and mint sauce, gammon, sweet and sour, curry, tomato (very popular in Scotland), sausage and tomato, pickled onion and prawn cocktail amongst many others.

Very few price increases have taken place for crisps during a period of quite substantial inflation. However, following the first budget of the new Conservative government of 1979 Value Added Tax was increased from 8 to 15 per cent, and this is chargeable on all snack products including crisps. (Increases in prices often take place by varying the quantity of crisps in the pack as the unit increase of one pence represents a large percentage increase in the price). Value Added Tax has been levied since April 1974 and it is often suggested that it is no coincidence that the industry has never attained the levels of output achieved in the year before that date.

Most of the major processors agree that the increase in VAT could jeopardise the recovery of sales from the stagnancy of the mid-1970s, a recovery which was just becoming evident.

It is estimated that in 1977 just over 40 per cent of crisps were bought through the grocery trade, almost 20 per cent through pubs and other establishments licensed for the sale of alcohol, 15 per cent through confectioners, tobacconists and newsagents, and about 25 per cent from other forms of outlet. Amongst the grocery trade more than half was accounted for by independent retailers, 35 per cent by multiples and 12 per cent by the co-ops. Many of the multiples will be selling their own-label brand. Each of the major processors is involved in manufacturing for own-label brands although one of these appears to have made a speciality of supplying this trade.

In the licensed trade crisps have held their own against the growth of other snacks and out-sell them by a very significant margin. In this market adults account for the vast majority of purchases. Within the confectioners, tobacconists and newsagents trade, crisps are still more important than snacks but in 1977 it is estimated only by a ratio of roughly 2 to 1. This is accounted for by the appeal of savoury snack products to children who are more likely to purchase from this kind of outlet. The savoury snack products are more a children's product than crisps and this partly explains why flavours are more important in the market for savoury snacks. Also because of the nature of manufacture the savoury snack market is much more open to development by the creation of new products and brands and the market is characterised by a wide range of these. The product names are obviously designed for a young audience, for example, Horror Bags (including bones, fangs and claws), Rock 'n' Rollers, Out-of-Spacers, Monstermunch, etc.).

Growth in demand for french fries has arisen from the increased demand for convenience foods; the growth in the number of meals eaten outside the home; the growth in the new form of take-away establishments which use prepared french fries (rather than fully preparing french fries themselves); the growth in freezer ownership and the rising cost of labour in catering establishments. In the same way as occurs in Continental Europe there are several distinct french fry markets which are differentiated largely by their quality requirements. It is estimated by the PMB that in 1977/8 72 per cent of frozen or chilled french fries were consumed outside the home (this excludes the vast majority of sales from traditional fish and chip shops which usually fry from raw potato). Within this catering market quality requirements differ with the very highest quality specification coming from the new fast food outlets which are opening in increasing numbers. Consumers buying at retail levels are generally less discriminating in terms of quality but are more sensitive to prices.

In several different ways one is able to identify the same kind of changes taking place in the United Kingdom market as has taken place in the United States much earlier. In particular the market is becoming increasingly specific with respect to quality factors and this is reflected in the growing number of distributors who are purchasing on the basis of written quality specifications.

The retail market has been limited to a certain extent by the problem of the relationship between the product price and the fresh potato price. However, in addition it is also constrained by a number of inherent problems

in the preparation of the product. Whilst a very popular food, there is often resistance to preparing potatoes in this form because frying with the traditional chip pan is often an unpleasant task for the housewife, with its associated smell, greasiness and safety hazard. In addition when the french fry preparation is over the housewife still has the disagreeable task of washing up the chip pan or finding somewhere out of the way to store it. If these inconveniences can be overcome the considerable potential for the development of the retail market will be increased. Oven-prepared french fries, currently marketed by McCain represent one such way of overcoming these problems.

The market for dehydrated products has continued to develop at a modest rate but the impact of imports has taken away many of the benefits of this development from domestic manufacturers. Three separate markets for potato granules and flakes can be distinguished, namely the retail, catering and industrial markets. The principal market for granules and agglomerates is the retail market. In this market there is least overseas competition because of the established positions of the brands of the two principal UK manufacturers. Indeed, in order to maintain their position in the retail market both major manufacturers are involved in substantial levels of advertising expenditure. This has to be an important part of their strategy because brand loyalty remains one of their principal planks of survival. Both of the British dehydrators sell an agglomerated product on the retail market and, again, this marketing innovation helps to protect them from foreign imports. A small quantity of flake is also sold in this market although flake is far less popular in the UK than it is in other European countries and brand names have found it difficult to get established.

Imports find it much more easy to compete in the catering market as contracts for bulk supplies are relatively easy to tender for from the United States or from any other European country. As flakes have to be prepared rather more carefully than granules to avoid the product going lumpy, this market is preferred to the retail market on the basis that professional cooks are more likely than housewives to be able to produce good quality product from flakes. The industrial market comprises two major groups, the manufacturers of snack products and the manufacturers of frozen products. The latter often utilise flakes and granules for potato croquettes, fish cakes etc. This is also a market in which it is relatively easy to import through bulk shipping and consequently competition from imports is strong.

Estimates included in a report prepared for Central Council for Agricultural and Horticultural Co-operation (CCAHC) in 1978 suggest that at that time apparent consumption of flakes in the United Kingdom was around 5,000 tonnes per year of which roughly half was utilised by snack manufacturers, and the rest split equally between caterers and the frozen food sector. Apparent consumption of granules was around 25,000-30,000 tonnes per year and retail outlets accounted for half of this with the rest being shared between catering and the snack manufacturers. The sector in which the domestic manufacturers are most secure, namely the retail market, has been the sector which is the most difficult to develop because consumers have not been prepared to pay sufficiently large premiums for the convenience of dehydration. In addition, at the retail level, the position of the dehydrators has not been helped by strong competition from frozen foods. However, the industrial and catering markets are growing, and in particular the growth of the savoury snack market in the UK has provided the industry with an important new outlet.

In 1977/8 just over half of canned whole potatoes were consumed outside of the home according to the estimates of the PMB. However, their statistics indicate that there is considerable year to year variation in the relative importance of domestic and non-domestic usage and too much weight must not be placed upon the 1977/8 figures. To many of the canners the object of canning potatoes is simply to maintain a full range of canned products for customers. Some of the manufacturers specialise in supplying the catering trade whereas others switch from market to market depending on where they see opportunities.

Institutional factors

The main institutional factor which has affected the British potato processing industry has been the existence of a system regulating the potato market. Some of the indirect effects of this system (such as the problems of getting producers to contract, obtaining the right varieties for processing etc.) have already been commented upon in the previous sub-sections and will not be specifically discussed here. The potato processors have very strong reservations about the operation of the stabilisation scheme which has recently been introduced in the United Kingdom. It is easy to see their concern as the stabilisation scheme could be managed to maintain prices at a level just below that which imports of potatoes would be attracted. Such measures will operate to the disadvantage of processors because the relative cost of transport of the processed product is cheaper than the cost of transport of raw potatoes. Consequently potatoes purchased in the Netherlands at much cheaper prices could be delivered to the British market in processed form at prices which undercut British processors purchasing potatoes at supported prices.

In fact, in the past, the granting of aids to the manufacturers of potato products has shown that the government acknowledge that in some circumstances the maintenance of a system of market regulation which includes support of the producers' prices has caused problems to processors. For example, in January 1978 the Ministry of Agriculture, Fisheries and Food announced that potato processors would be able to purchase at special prices, potatoes taken off the market as part of market support measures for that season. To quote the government of the day, this arose because "potato processors found themselves in difficulties and have cut back their operations; these difficulties will be exacerbated as farm gate prices rise in response to the current market support programme undertaken by the Potato Marketing Board with Exchequer assistance". Similar arrangements were made in April 1979 but this time only potato granule and flake manufacturers were able to purchase supplies withdrawn from the market. At this particular time there were fairly high levels of imports from potato granules and flakes into the United Kingdom and again the price of domestically produced raw material had been pushed higher by PMB operations.

The aids given to co-operative organisations within the potato marketing system have already been mentioned. These constitute an important institutional factor affecting the marketing system as a whole but, as yet, have had little direct effect on the processing sector.

In an attempt to modernise the infrastructure of marketing and processing in the potato sector, regional programmes have been prepared under EEC Regulation 355/77. The proposed programme covering England and Wales is particularly interesting because it closely involves the potato processing sector. In particular it aims to develop the marketing of

potatoes by providing greater incentives for the establishment of adequate storage and grading facilities in recognition that effective division of the crop will be an important feature of efficient potato marketing in the future. In addition, the programme also identifies the potato processing sector as requiring assistance, for improved processing facilities and increased capacity to meet an increasing market are seen as necessary to develop the most secure long-term markets for potatoes grown in England and Wales. The programme suggests that the market for french fries will increase quite substantially and that of crisps and dehydrated potato products at more modest rates and that these developments can only be met from existing capacity in the dehydrated products sector. The programme aims to stimulate investment so that the processing sector can maintain its international competitiveness. The programme is devised to promote sufficient investment during the three years of the programme to ensure sufficient capacity exists to meet the expected expansion in demand up to 1983/4. Although the programme admits that it is difficult to estimate the level of investment required, it acknowledges that to bring about the required increases in capacity in the crisp and french fries sectors, 15 million pounds of grant-aided investment is expected to be required (for new factories or extending existing areas) and in addition the improvement and minor extension of existing factories and associated stores (e.g. better handling and preparation equipment, environmentally controlled stores, new and improved processing equipment etc.) will require a further 7 million pounds. The programme identifies projects already planned, shortly to be completed or in advanced stages of planning totalling some 17.6 million pounds (at 1979 costs). Under EEC Regulation 355/77 FEOGA assistance must be matched by national aids and in the United Kingdom there are a number of ways in which this can be assured. Co-operatives can normally obtain assistance under the Agricultural and Horticultural Co-operation scheme 1971 and others can obtain assistance through the Agricultural Products Processing and Marketing (improvement grant) Regulation 1977. Some private organisations may also be eligible for assistance under regional aid schemes.

In the United Kingdom there are specific regulations limiting the use of a large number of food additives. Separate maximum levels are specified for a range of different products for each different group of additives. For example, for potato flakes and granules a maximum of 0.025 per cent BHA and 0.025 per cent BHT are permitted and for dehydrated potato 550 milligrams per kilogram of sulphur dioxide. The attitude among most of the British manufacturers seems to be that the legislation on food additives presents them with very few problems and that some restrictions are necessary.

In the United Kingdom the establishment of waste water quality standards is decentralised and the competent authorities tend to be either the river authorities or municipal authorities. The processing companies are charged for the treatment of industrial effluent on the basis of the operating costs of any treatment plant (by the application of an appropriate formula).

* * *

To summarise, the institutional factors which have shaped the British potato production sector have also left their mark on the potato processing industry. These institutional factors, notably the attempts to regulate the potato market, represent a problem for some potato processors. The industry

is characterised by a very large crisp industry which continues to expand at a modest rate. The french fry sector is still relatively new but continues to expand more rapidly. The dehydration sector has been threatened by North American competition but has shown flexibility and initiative in seeking out new raw material procurement methods to bolster its competitive position. A wide range of different methods have been adopted to overcome the problems of raw material procurement and generalisation is hazardous. The crisp industry appears to be moving towards more direct contact with producers in order to control quality although it is recognised that wholesalers will still play a very important function. Concern over quality is also the main motivation for french fry manufacturers to establish close links with individual producers or producer groups, although, again, wholesalers have performed a very valuable function and play an important role. In its transition towards a less regulated market the British high priority is being given to meeting the requirements of the expanding processing industry and this has been encouraged by the potato programme under EEC Regulation 355/77.

(v) THE POTATO PROCESSING INDUSTRY OF IRELAND

The potato sector

Because of the importance of the potato in the history of the Irish economy and the profound social effect that the complete failure of the Irish potato crop in 1846 had upon the nation, the potato is still regarded in Ireland as a rather special crop. The area of potatoes reached a peak in 1859 when 374,000 hectares were grown. Since then this area has been reduced to 136,000 hectares in 1950 and to 47,000 hectares in 1976. This reduction in the area of potatoes is chiefly due to the decline in the use of potatoes for animal feed. In addition to this, as in many other countries, the area of potatoes cultivated has been under pressure to contract because of a substantial increase in the average yield of potatoes coupled with a decline in the consumption of potatoes per head of the population. In recent years, farmers have been attracted by other enterprises which offer a more stable return than the potato crop, which is notorious for its instability as a result of fluctuations in supply from year to year. The declining importance of the potato sector is a common feature in EEC countries, and, with the possible exception of the development of the Dutch potato sector, it is the backcloth against which developments in the potato processing industry must be considered.

The decline in the importance of the potato sector has been greater in some parts of the country than in others. Those areas which have the best conditions for potato growing have experienced a much less pronounced decline and consequently, today production is rather more concentrated in the better potato growing areas such as County Dublin and County Meath. The decline has also been slower in the major seed growing area of County Donegal. The number of producers growing potatoes has declined quite considerably although the average area of potatoes per grower is still very low at 0.36 hectares. As will be apparent from this figure there still remains a large number of farmers in the industry who are growing very small areas of potatoes. Figures for 1970 suggest that only 1.7 per cent of the 156,000 growers at the time were growing more than 2 hectares. However, there is a feeling that more recently the size distribution may have changed as a number of growers in the better production areas have begun to specialise in the potato crop on fairly large areas although unfortunately there are no statistics available to confirm this. The past few years have seen the emergence of a small group of farmers in the main production areas to the north of Dublin who have begun to grow on a substantial scale (some grow more than 250 hectares). Whilst some of this may have been encouraged by the possible rewards of speculation in the potato crop, especially since the boom years of 1975 and 1976, there seems to be some evidence that some of these producers are taking a progressive approach to the production and marketing of their potato crop.

There has always been some dispute over the precise level of potato production within Ireland as it was always very difficult to square producers' planted area and average yields with the final production coming onto the market. It was always assumed that the difference (invariably estimated production exceeded estimated demand) comprised outgrades from the ware crop, wastage because of disease and storage losses and illegal exports, although there is also a suspicion that area returns may well be biased in an upward direction because many of the small producers tend to round up their planted area on the census returns.

The production of potatoes for domestic or non-commercial consumption is a common feature of the potato sector of Ireland just as it is of several other European countries. Consequently the supplies coming onto the market for sale derive mainly from the specialist production areas of counties Dublin, Meath and Donegal. However, the dribble of supplies from the non-commercial producers can have an important effect on the development of the market and do represent a factor which contributes to the inherent instability of the sector.

Total production is believed to be around 1 million tonnes compared to 2.3 million tonnes between 1955 and 1959. It is estimated that only 350,000 to 400,000 tonnes are used for human consumption with the rest being accounted for by seed use, feed and wastage although as previously noted the data on the precise levels of each of these categories is extremely imprecise. There have always been difficulties in assessing the level of cross border trade between Ireland and Northern Ireland but it is believed that fairly substantial quantities move across the borders in both directions from year to year and escape official control. The officially recorded value of imports is relatively small and comprise new potatoes for the ware market which fill the gap between the end of the old crop and the availability of domestic early supplies. Seed potatoes account for between 30-35,000 tonnes of exports.

Historically there has been control over the importation of potatoes into Ireland and prior to full entry into the EEC tariffs operated. However, after full accession tariffs on imports from EEC countries were abolished, although the Irish government continued to maintain stringent plant health standards which have effectively banned imports.

The consumption of potatoes per head of the population is now around 110 kg per person per year which makes it one of the highest levels of potato consumption within the Community.

The principal maincrop varieties grown in Ireland are Kerr's Pink, Record and Golden Wonder with the main second early being British Queen and the main first early Home Guard. All of the maincrop potatoes have high dry matter content and when cooked give a floury texture. The variety Record was introduced into Ireland in 1954 in order to supply two factories which had been converted from the production of alcohol from potatoes to the production of starch. The manufacture of starch finished in 1964 but by this time the variety Record was being widely sold on the ware market as it suited consumers' preferences. Both Kerr's Pink and Record have been found to be suitable for the potato processing industries of Ireland.

The manufacture of potato products

The potato processing sector still remains relatively small when compared with the industries of some of the other European countries. After a promising beginning in the early 1960s the industry has recently suffered a set back because of the closure of one of the major potato processing units. This plant, the Erin Foods dehydrated potato production plant, ceased manufacturing potato flakes and dehydrated potato pieces in December 1978. Although the plant is now idle it appears that there is a political commitment to keep the plant going in one way or another although it would seem that its location, in the west of the country and away from the principal potato growing areas, would continue to put a large question-mark over its re-establishment in an economic form. Consequently the only

remaining processing industries are four moderately sized crisp factories, although there are plans, some in an advanced stage, for the establishment of another crisp factory and for two french fry manufacturing plants. (It is not known precisely what kind of processing may be undertaken at the Erin Foods plant should it be re-established as a commercially viable organisation).

A brief account of the historical development of the potato processing sector illustrates many of the problems of establishing a potato processing enterprise in Ireland and provides a basis for understanding the status of the sector. Perhaps one should begin an account of the history of potato processing in Ireland with the Industrial Alcohol Acts of 1934 and 1938 which established alcohol factories to absorb surplus potatoes. In the early 1950s it was recognised that the system was not operating effectively and consequently two factories were converted to potato starch manufacture. This continued until 1964 when that enterprise was also abandoned because the starch manufacturing company experienced problems in holding farmers to their contractual commitments. Additionally the market situation for potato starch at that particular point in time was not very good and consequently the factories closed. Just before this, in 1961, a potato flake factory was established by the Erin Foods division of the Irish Sugar Company (a government company) at Tuam, a small country town in County Galway to the west of the country. The precise reasons for the location of the factory are not accurately known but it is believed that a major consideration was the wide availability of potatoes in the area at that particular time and the availability of factory space at the site of an existing sugar factory operated by the company. The choice of location proved to be absolutely critical to its long-term viability, for the developments described in the first paragraph of this section had a very serious effect on the potential for developing the Tuam plant. By 1970/71 almost 40,000 tonnes of potatoes were being processed, and by this time a line for producing dehydrated potato pieces had been added to the two potato flake lines to raise the capacity of the plant to about 45,000 tonnes. However with the decline in the area of potatoes grown in Ireland there was a fairly rapid decline in the availability of potatoes around the Tuam factory and consequently potatoes were being drawn mainly from the east of the country where the potato area had declined at a slower rate. During the early days of the factory there were fairly large quantities of potatoes being used for animal feed and frequent surpluses of potatoes, hence contract prices paid to farmers were very low and remained at low levels until 1974 (the contract price was £9 per tonne in 1961 and £11 in 1974).

From the beginning the company experienced problems because they contracted on an area basis and they soon realised that they were not receiving the total yield from that area when prices on the ware market were attractive. But even when they switched to contracts on a tonnage basis they still had great difficulty in holding farmers to their contracts. For example in 1972/73 they contracted for 26,000 tonnes of potatoes, but because of higher ware market prices only 7,000 tonnes were delivered. This obviously placed the company in a very serious position as continuity of supplies could not be guaranteed at prices which the market for the product could stand. Finally, following the problems of the two drought years, when farmers only delivered 25 per cent in 1975 and 50 per cent in 1976 of contractual obligations, the company began production of potatoes themselves only to be overtaken by the increasingly difficult market situation for dehydrated products as a result of North American competition.

In any case, the survival of the factory seems very doubtful given the problems of raw material supply and the extremely unsatisfactory location of the plant away from the main potato producing areas. It is difficult to understand why producers were not held to their contracts, although it has been suggested that this would have been politically unviable given that the Irish Sugar Company was a government sponsored organisation.

On top of this, it seems as though many Irish potato growers found it very difficult to adapt to the requirements of this new industry with its tight quality requirements, and to all intents and purposes considered its requirements in the same terms as those of the sugar beet industry which they were used to supplying. Although bonuses were paid for dry matter content for a period, it is doubtful whether this acted as any incentive at all for the growers to maintain solids content. The position of the manufacturers was also weakened by the strong growers' organisation (the Beet and Vegetable growers' Association, BVA) which negotiated contracts and provided quality checks on the potatoes delivered to the factory. It is normal to find such strong organisations of growers in those potato processing sectors which are fairly mature in terms of development and it is only explained in the case of Ireland because of the existence of a well-developed sugar beet industry in which the beet growers' representatives played an important part. Such growers organisations usually represent a fairly healthy feature of the sector, as a well-disciplined organisation can pursue the interests of its members whilst taking into full consideration the long-term interests of the manufacturer. However in this particular case it seems the growers organisation did not have the necessary discipline over its members.

Despite the problems of raw material supply and location, attempts to restart potato processing are still continuing although the problems which need to be overcome are enormous.

The crisp industry in Ireland has a much more orderly history. It was founded in 1954 when a small potato crisp frying establishment was set up in the middle of Dublin. The brand name Tayto was established and in 1967 a majority of the shares in the organisation were bought by Beatrice Foods Corporation of the United States and a new factory was built to the north of Dublin. This organisation is in the process of establishing a new plant further to the north of Dublin in the major potato production area. They also have a smaller factory which produces mainly potato snacks and which is sold under the 'King' brand. Tayto were joined in the crisp market by Smiths in 1964. This company was associated with the British crisp manufacturers, Smiths, although they now only have very loose connections with the United Kingdom organisations (which are now owned by the Associated Biscuit Group). Jacobs, part of Irish Biscuit Manufacturers, acquired an interest in Smiths which was later bought out by a wholly owned Irish company and then in 1977 was eventually taken over by an organisation called Leventis Holdings which is a Luxembourg registered company. A third company called Perri Potato Crisps, run by an Italian ice cream manufacturing company was in existence until 1976 when, mainly because of the difficulties in purchasing potatoes during that year, it went out of the crisp sector. A new entrant to the crisp market is the Smailc Bhia food company of Donegal. This newcomer is primarily involved in exporting crisps and at the present time is processing only a relatively small quantity of potatoes.

The location of the existing crisp factories has been dictated by the availability of raw material and the proximity of the major market. As a fairly large proportion of the Irish population lives in Dublin there is a quite substantial concentration of the market for crisps and snacks in this particular area. As the principal potato production areas are also just to the north of Dublin, this represents the optimum location for such plants bearing in mind that the Dublin area can also supply the necessary labour. The Smiths factory is to the south of the city so in this respect is not ideally placed and also suffers slightly from the fact that it is located in an urban area which could produce some problems as a result of noise or smell nuisance. The new Smailc Bhia factory in Donegal was established mainly on the basis of supplies being available as outgrades from the seed crop which is concentrated in that area, although apparently the exercise has not been without its difficulties. The location of this plant in Donegal was strongly influenced by the availability of funds through a government agency (Gaeltarra Eireann) which provides fairly substantial financial assistance for organisations who wish to invest in Gaelic speaking parts of Ireland.

In 1979 the crisp market could possibly absorb something like 30,000 tonnes of potatoes per year. It is estimated that the domestic market will be valued at something like £7m including snack products and it is growing at something like 5 per cent per annum.

The plans for the installation of two factories to manufacture french fries has been prompted by the rise in demand for french fries within the Irish Republic. At the present time this demand is met from imports mainly from the United Kingdom. Proposals are being developed under the auspices of the Irish government sponsored Irish Development Authority. Should the french fry industry get established, it seems highly likely that it too will be located in that area north of Dublin which includes the best agricultural land for potato production. However, there are also plans to establish a french fry manufacturing plant in Donegal, which like the snack company, would obtain its raw material from outgrades of the seed production sector. Like the snack food factory in Donegal this plant would almost certainly have to concentrate upon supplying export markets because its location in Donegal excludes any possibility of developing a market within the Irish Republic. Again this plant would be eligible for quite substantial assistance from government agencies and its location is very closely related to the government efforts to overcome the problems of unemployment in Donegal.

The Irish Sugar Company, through Erin Foods, are also involved in the production of canned potatoes through a joint enterprise with a co-operative organisation in the south west of the country in County Cork. This is the only organisation involved in canning potatoes in Ireland and it began in the early 1970s. Canned potatoes represent only a small part of the total business of this company. The output from the contracted area of King Edward potatoes are canned during the period July and early August and sold mainly for export. The company cans several vegetables and branched into potatoes in order to fully utilise its machinery throughout the whole of the year. The enterprise has proved fairly successful with export markets being exploited. The quantity of potatoes canned is limited by the need to can other crops during other parts of the year.

There is very little information on the levels of external trade in potato products in Ireland. Because of the very high costs of transport of

crisps external trade is limited. A number of brands are imported into Ireland from the United Kingdom but the quantity involved is very small. In addition, crisps are exported to the United Kingdom from the Donegal snack factory through the agency of Adam Foods a part of the Irish Dairy Board. It is estimated that some 5,000 tonnes of frozen french fries are being imported at the present time and the quantity is increasing rapidly. Imports of dehydrated potato products are quite small, running at approximately 700 tonnes per annum although with the closure of the Erin Foods plant, this may increase slightly. The canning factory in Cork supplies all the requirements of the Irish market which are not very substantial, and the rest is exported.

We have already seen that there have been very substantial problems with organising the raw material supply for potato processing factories in Ireland. The problems of the Erin Foods factory in Tuam have also been faced to a much lesser extent by the crisp manufacturers. The varieties sold on the ware market in Ireland are perfectly suitable for crisp manufacture although, because of the critical influence of storage procedures upon the sugar content and hence colour, much greater control over quality is achieved through contracts. One crisp manufacturer has tried a number of contracting procedures. The first method resembled the contracting procedures used in the Netherlands, with the processor taking out a contract with a merchant, and leaving him with the responsibility of procuring suitable potatoes from growers by contract. This proved to be completely unsatisfactory as far as the merchant was concerned because when he was let down by growers (as he frequently was), he had an extremely difficult time fulfilling his obligations to the factory. The system was therefore changed so that the processor contracted directly with the grower leaving the merchant with the responsibility of storage. This carried on quite satisfactorily until the seasons of 1975 and 1976 when the processors were let down so badly on contracts that they decided that an alternative system must be adopted. The new method involved the processors themselves undertaking the responsibility for production by hiring land from competent growers and paying them contract rates for all the cultural practices, harvest and transport. A merchant played an intermediary role, acting as an agent for the processors. Because of the relatively good farming structure in this area only a very small number of contractors are required. This system seems to have worked extremely well during the 1977 and 1978 seasons. The processors feel that they have got their raw material at a reasonable price; they also are happy with the quality of their raw material as they have selected those who they consider to be the best and most loyal producers. The producers feel happy because they are receiving an adequate return for very little risk with every incentive to push up the yield (because they receive a bonus payment based on the extent to which they exceed a minimum yield) and quality.

The other crisp manufacturer purchases his supplies directly from two or three large growers on a contract basis. With the encouragement of the Department of Agriculture they have jointly invested with growers in storage which will provide the necessary supplies to get through the very difficult summer supply period, thus reducing the need to import during the summer months. However there still seems to be a problem during these months and the crisp manufacturers continue to ask for import licences so that they can procure imported material during this period.

Those producers who supply processors are contracted to supply potatoes suitable for crisp production and this is interpreted to mean a

21 per cent dry matter content and the level of tolerance to disease and damage laid down in the British ware standard. The variety Record is almost exclusively used, although several other varieties have been tried. In particular Desirée was found to be very acceptable although its tendency to grow long did present some very difficult problems in the packaging stage. The market is said to be far less fussy about quality than the British market and consequently sugar levels are far less critical, although one of the companies does have facilities for blanching which it considers is a much more economic way of controlling for sugars than conditioning.

The demand for crisps is increasing fairly rapidly and, as previously indicated, new investment is anticipated. Both the crisp manufacturers supply the Irish Republic and Northern Ireland although there is another factory in Northern Ireland producing crisps under the Tayto brand. This Northern Ireland factory is believed to be under separate ownership and Irish Tayto crisps are sold into the province under the 'King' brand. Within the Republic it is suggested that the Smiths brand has made much slower progress partly because of being the second manufacturer into the market, but also because of its English connections although the Smiths brand name is now rarely used.

Unflavoured crisps only represent a very small proportion of the market (roughly 20 per cent) and the market in the Republic is dominated by the cheese and onion flavour. This accounts for almost the entire flavoured part of the market.

The distribution of crisps is carried out exclusively by the crisp manufacturers' own transport, driven by driver/salesmen. Both the major crisp firms also manufacture snack products and pack peanuts and popcorn which are distributed by the same method. The snack products include a small range of extruded products although demand for these is growing.

In the Irish potato products sector there are two institutional factors which have proved to be important in the development of the sector. First the ban on imports has been quite a problem for some of the processors during the difficult summer months. In other periods of the year they are unaffected because they have their own contracted supplies. The second institutional factor has been the activities of the Industrial Development Authority (IDA). The IDA has played an important part in assisting the development of the crisp sector and of promoting other possible developments in the potato processing sector in its bid to increase employment opportunities in the country. They offer re-equipment and expansion grants which have been used by the two major crisp manufacturers. The IDA can also provide a number of advanced factories on industrial sites throughout Ireland and one crisp manufacturer is planning to expand into one of these. In addition, as previously noted, the government sponsored Gaeltarra Eireann also offers fairly substantial assistance for the companies establishing themselves in Gaelic speaking areas. There are few other institutional factors which affect the industry and generally there seems less restriction on the activities of the processors than in other EEC countries, for example, there seems to be far less control over the levels of effluent which are discharged by the major crisp manufacturers centred around Dublin although, the Erin Foods potato processing plant was presented with quite considerable problems in disposing of effluent because of its likely effect on trout populations in

local rivers. They were forced to invest quite heavily in effluent treatment plants and settling ponds.

* * *

To conclude, the development of the potato processing industry has probably had less impact in Ireland than in any other EEC country with the possible exception of Italy, Denmark and Luxembourg. It appears as though the crisp sector will continue to grow and there seems every possibility that a home based french fry industry could be established on a relatively small scale. In terms of numbers of individuals involved, the impact on the agricultural community at the present time is very insignificant, for probably less than 10 growers are supplying the two major crisp manufacturers with the bulk of their supplies. On the other hand, the experience of the Erin Foods exercise in County Galway has had a substantial psychological impact upon the agricultural community. Those experiences suggest that the potato production sector is inadequately developed to supply the needs of the potato processing sector except in those parts of the country where contracts can be arranged with a small number of reliable growers. It has been suggested that the development of producer groups would overcome this problem, although one suspects that producer groups would be completely unacceptable to most Irish producers, both small and large scale, who seem to welcome the opportunity for speculation on the potato market.

(vi) THE POTATO PROCESSING INDUSTRY OF BELGIUM

The potato sector

The area of potatoes grown in Belgium has reduced quite significantly since the end of the Second World War. In 1950, 83,000 hectares of potatoes were being grown whereas in 1977 the figure was 41,000 hectares. The most rapid period of contraction came during the late 1950s, early 1960s and by 1965 the area had already fallen to 50,000 hectares. During the 1970s the area of potatoes grown varied between 42,000 hectares and 36,000 hectares (of which seed potatoes have accounted for roughly 400 hectares). Potato production during the early 1950s was distributed throughout the whole of the country but has gradually become more concentrated in the regions to the west of the country. In these areas the soils are better for potato production and the structure of production is also more favourable. In 1978 almost 40 per cent of the total potato area was concentrated in the province of West Flanders and another 23 per cent in East Flanders. The next most important province is Hainaut (also situated to the west of the country) which accounts for 16 per cent of the potato area. The area behind the dunes on the West Flanders coast comprises polder soils which resemble those of the Netherlands and are very satisfactory for potato production.

Apart from a relatively small seed sector, potatoes are produced primarily for human consumption, although varying quantities are fed to stock feed depending upon market prices. Compared to other EEC countries the manufacture of potato products is relatively insignificant.

With the increasing concentration of production on the larger farms to the west of the country the average area of potatoes grown per farm has also risen since the last World War. In 1977 the average area of potatoes grown on each potato holding was 0.63 hectares. The 5,000 producers growing more than 30 hectares of potatoes accounted for 10,325 hectares of potatoes, roughly 25 per cent of total production. Despite the fall in area because of increases in yields, the production of the Belgian potato industry has been maintained at around 1.5 million tonnes since the late 1950s (in 1977 1.6 million tonnes were produced). The effect of variations in the area of potatoes planted and in the yield per hectare has been a very variable level of production, and consequently the Belgian potato industry is characterised by a very high degree of price instability.

Belgium is a regular importer and exporter of potatoes on a fairly substantial scale. Most of the imports of maincrop potatoes come from the Netherlands and early potatoes from France and Italy. Belgium exports service a wide range of countries but particularly its immediate neighbours of West Germany, France and the Netherlands. The quantity of potatoes exported varies considerably from year to year in response to domestic and European market circumstances.

In the Belgium/Luxembourg Economic Union (BLEU) the quantity of potatoes moving into consumption was 1.3 million tonnes in 1955/56. This has slowly decreased to just over 1 million tonnes in the mid-1970s. During this period consumption per head fell from 146 kilograms per person per annum to approximately 100 kilograms per person per annum in the mid-1970s (the figure for the drought affected season of 1976/77 was 98 kilograms but it was 7 kilograms higher in the previous year).

Bintje is the most widely cultivated variety although there are no statistics which quantify the true extent of its popularity. It is known that 95 per cent of the seed potatoes used in Belgium is imported from the Netherlands and for those consignments which are recorded (about half) Bintje accounts for 50 per cent. The early varieties Eersteling and Climax are the next most important varieties.

There are some 800 wholesalers involved in the Belgium potato marketing system, of which many are operating on an occasional and small-scale basis. It is estimated that only 300 are regularly involved in the potato trade. However, there are three very large wholesalers who play a very important part in the exporting of potatoes from Belgium and one of these operates the largest processing plant in the country. These three companies account for 75 per cent of all exports, although they do not necessarily handle exclusively Belgian potatoes. There are no co-operatives operating in the potato industry mainly because they have found it very difficult to operate in such an unstable market. A number of co-operative ventures were set up but they have not been successful and now the wholesaling of potatoes is carried out exclusively by wholesalers. Because of a general reluctance to co-operate in this sector there are also no producer groups in operation and the absence of a potato processing industry of any size has undoubtedly constrained any such developments.

The Belgian potato market has been operating with the minimum of government interference over a fairly long period of time. There are controls on the imports of early potatoes but the only government involvement in the maincrop sector is the adoption of measures to improve the overall quality of potatoes. Potato wholesalers have to be licensed and retailers can only purchase their potatoes through these licensed wholesalers. The licensed wholesalers are regularly checked to ensure that they are maintaining quality standards. Sales direct from producers to consumers are excluded from control as are sales to factories manufacturing potato products. The Belgian government did introduce controls on exports in 1975 but this was in response to the French government banning exports. These measures were considered essential because the control on French exports meant that Belgian and Dutch potatoes were the only potatoes available in Europe for export and Belgian prices were being forced to very high levels. The problem was made more acute because Belgian salaries are linked very closely to the cost of living index and as potato prices represent a fairly important element in the calculation of the index (apparently for every rise in the potato price of 1 franc the index goes up 0.28 points) the government had to take some action to prevent salaries rising out of all proportion. Today it would not be possible to introduce such controls on exports because of the ruling in the European Court of Justice on the Charmasson case in 1974.

The history of very unstable prices both within seasons and between seasons has played an important part in shaping the overall potato sector of Belgium. Growers consider potatoes as a speculative crop and consequently this has militated against the formation of co-operatives at the production and marketing level and to a certain extent may have restricted the development of the potato processing sector as processors have found it almost impossible to establish a contractual basis for procurement of raw material.

The manufacture of potato products

Potato products began appearing on the Belgian market at the beginning of the 1960s but between that date and the present day the processing of potatoes in Belgium has developed very little. Unfortunately no statistics are collected on a systematic basis and so it is very difficult to chart the progress of the sector.

The manufacture of potato products has had, to say the least, a very chequered history in Belgium. Apparently the first manufacture of french fries came in the late 1950s. In 1959 a catering chain called Hubandro began to prepare and first fry at a central location the french fries required for each of its restaurants. On a daily basis french fries were distributed to each of the restaurants in the chain and sold to other caterers under the name 'Goldfrit'. It is understood that this organisation was for many years the only organisation manufacturing french fries on any scale (and this was a very modest scale in relation to some of the organisations which had been set up at the same time in other countries). The mid-sixties saw the emergence of two small french fry manufacturers. One, Eurofreez, established a factory for the production of french fries and croquettes in West Flanders, near the French border. The other, an organisation called Belfood (Belgian Food Industry), of which the principal shareholders were the Boerenbond (the Belgian Farmers Union) and a number of government sponsored organisations, established a factory at Nivelles for the manufacture of french fries, croquettes and other potato products. In 1971 this company went bankrupt and was taken over by the company Cobelal SA, of which the most important shareholder was SA Assurances du Boerenbond belge. However this company soon ran into difficulties and was taken over by Eurofreez in 1972. Eurofreez has not been without its problems and it is understood that at one stage during its existence one of its principal creditors (a potato wholesaler) took control of the company in order to maintain its operation. Eurofreez no longer operates the factory at Nivelles.

In 1968 a co-operative named Lieco in the province of Hainaut began to process potatoes into potato flakes and french fries at Leuze. In 1970 this organisation went bankrupt and it was acquired by a Dutch organisation called Jaczon-Diepvries (operating in Belgium as Jaczon-Frigo). This organisation also produced potato flakes in addition to french fries although the main emphasis of the organisation was on the latter group of products. In 1972 this organisation was processing about 20,000 tonnes of potatoes and was the largest of the two organisations producing french fries in the country at that particular time (the other was Eurofreez). (Hubrando was still only operating on a very small scale supplying mainly its own restaurants). In 1977 Jaczon-Frigo went bankrupt and was taken over by one of the three big potato wholesalers, Van den Broeke trading as Gastropom. Apparently the original co-operative at Leuze had received aid from the State to establish the factory to the tune of 75 million Belgian francs and the town of Leuze itself had invested 10 million Belgian francs in the enterprise. Also, when the organisation was taken over by Jaczon-Frigo it received subsidies of 40-50 million Belgian francs from the Belgian government. In 1979 a new factory began production at Lommel in the province of Limburg. This factory was established by a Dutch firm with German capital but has been operated by the large Dutch manufacturer of french fries, Van Tuyl. The factory is located in an area of fairly high unemployment and quite substantial incentives are understood to have been available from the Belgian government to assist in the establishment of the factory.

In the early 1960s dehydrated potato products began to appear on the Belgian market. In particular companies from the United Kingdom, West Germany, Sweden and the multi-national Unilever attempted to establish themselves in this market but the quantities sold were very insignificant at this stage. In 1964 Nestlé and CPC launched their products on the market. These products were manufactured in France and were sold under the same brand names as were used in France. In the same way as occurred in France the Nestlé product Mousline achieved greater initial success and in 1966 CPC withdrew its product Stocki from the retail market (although continued to sell it to caterers). Stocki was a potato granule and encountered the same problems of consumer acceptability in Belgium as had been experienced in France. A croquette preparation was marketed for the first time in 1969 by CPC and was followed in 1972 by Nestlé. The contribution of domestic manufacturers to this market was relatively insignificant until the involvement of Van den Broeke in the manufacture of potato flakes in 1977. However, even today most of the products sold on the Belgian market are imported.

The sale of crisps began in the Belgian market during the 1960s when the British group Smiths distributed crisps in Belgium from a factory based in the Netherlands. The development of the market has come almost exclusively from crisps manufactured either in the Netherlands or in France. There has been only one crisp manufacturer located in Belgium. A factory was established by a company called Westimex in the late 1960s at Nieuwkerke in West Flanders near to the French border. In 1971 the British company United Biscuits took over the factory and, as part of a rationalisation exercise in 1974, moved production to a location further west in West Flanders at Veurne. As part of the rationalisation another factory it had purchased in the Netherlands was closed down and United Biscuits' interest in the European crisp industry was centred on the factory at Veurne. This factory remains the sole manufacturer of crisps in Belgium.

A number of canning organisations have canned potatoes at one time or another although only very small quantities are sold onto the domestic market. Very little information exists on the historical development of this sector.

To summarise then, in 1979 the Belgian potato products industry comprised four main organisations. The largest is the Van den Broeke factory located at Leuze which produces french fries and dehydrated products. This factory is located at Leuze mainly for historical reasons but it is well within reach of good quality potato land. There are two other manufacturers of french fries. One is Eurofreez located in the south of the country on the border with France, again within easy reach of good potato land on both sides of the border. The other french fry factory is located in the north of the country and is not particularly well placed in relation to Belgian grown potatoes. It is however very close to the Dutch border and, as it is now owned by a Dutch organisation with quite considerable interests in the wholesaling of potatoes, it seems inevitable that this factory will be supplied by Dutch potatoes. The only other factory of size is the crisp manufacturing plant located in one of the best production areas of the country in West Flanders. The total sector probably utilises roughly 80,000 tonnes of potato, of which a fair proportion would be grown outside Belgium.

One of the biggest problems for any organisation concerned with the manufacture of potato products in Belgium is the difficulty in getting

farmers to participate in contracts. Because potato production is considered as a very speculative activity very few Belgian farmers are prepared to participate in contracts. Belgian producers are well aware of the speculative nature of the potato market and they recognise that any sales on fixed price contracts could mean the forfeiting of quite substantial profits in any given year. The largest potato manufacturer in Belgium, the Van den Broeke organisation, has got round the problem by growing the potatoes themselves on rented land. The organisation grows potatoes on 800 hectares of land and only contracts from farmers for a very small proportion of their supplies (100 hectares). In addition purchases are made from the ware market to provide that little bit of flexibility which is needed from season to season. As Van den Broeke is a potato wholesaling organisation, the procurement of these ware market potatoes represents no difficulty. The Van den Broeke organisation operates on an international scale and consequently can draw potatoes from France, Holland or Belgium, whichever is the best at any given point in time (it even has its own wholesaling organisation in France).

All the major potato processing manufacturers in Belgium are utilising the variety Bintje. However, the crisp manufacturer is turning more and more to Saturna with its much lower reducing sugar content and its high dry matter content. The principal problem with Saturna is its greater susceptibility to blackspot and bruising than Bintje, probably because of its higher dry matter content. However Saturna responds much better to conditioning. It seems that Saturna is slightly more difficult to get hold of than Bintje and this may represent a problem for the future.

The crisp manufacturer, which is probably the second largest potato product manufacturer in Belgium, relies upon wholesalers for the supply of raw material. This manufacturer considers that wholesalers have the expertise of assembling and grading potatoes and for manufacturers to get too involved in this takes them into a completely new area of activity and responsibility. The majority of the raw material for this factory is bought in Holland where the suppliers have much greater experience in supplying potato processing plants. The Belgian wholesaling sector has not had the same kind of experience in supplying the potato processing sector and neither does it get the same kind of support or back-up from national institutions which the Dutch wholesale trade receives. There may be fewer problems for french fry manufacturers in using supplies grown in Belgium because raw material quality considerations, though important, are seldom as critical as appears to be the case in the crisp sector.

There are no statistics publicly available on the level of demand for the various potato products sold in Belgium. Data on external trade is limited to dehydrated potato products.

There seems to be very strong resistence among Belgian consumers to frozen french fries and consequently only a relatively small proportion of available supplies are sold through retail outlets. The demand from the catering sector has been mainly for fresh or chilled french fries but more recently the demand for frozen french fries is understood to have increased. Many of the cooks in the smaller catering outlets, including the many chip-stands found in Belgium, prefer to prepare their french fries from raw potatoes. The same pattern also applies to other fried non-snack products. Amongst households there is a preference to make potato croquettes from raw potatoes rather than buy them in frozen form. However the market for these products is understood to have increased steadily during the 1970s. In

view of difficulties developing the domestic market the manufacturers of french fries are heavily involved in exporting.

Exactly the same can be said about the dehydrated potato market, for the quantity consumed is very modest. The principal manufacturer is involved mainly in exporting to other countries and the strongest brands on the Belgian market tend to be those of foreign manufacturers. In particular Nestlé hold an important position in the market with their sales of flakes under the Mousline brand. In recent years the sales of private labels has increased although it is understood that imports are mainly used for these. Like many other dehydrated potato sectors around Europe the importation of North American products has become an important feature, particularly following the large scale importations during 1975/6 and 1976/7. As a result of this competition, output of dehydrated products in Belgium suffered quite seriously. The data available on external trade reveals imports of potato granules and flakes of 1,500 - 2,500 tonnes (if one excludes 1975/6 and 1976/7 when almost 3,000 tonnes were imported). The export figures suggest that in some years re-exporting takes place for the quantity of product exported exceeds the quantity being produced at the time. In addition there is an extremely small amount of trade in both directions in dehydrated potato pieces.

The crisp market is understood to have developed fairly steadily. Nielson figures on crisp consumption were published from 1967 to 1971 but are not available since that date, although trade sources confirm that the early trends revealed by Nielson have been maintained. Like most of continental Europe there is a marked lack of interest in flavours and only paprika has managed to become established. As noted earlier the market was initially established by imported products and this explains why two imported brands, Smiths and Samo (now understood to be produced by Flodor in France) are brand leaders of which Smiths is understood to hold the largest market share. Paradoxically the only Belgian producer is heavily involved in exporting crisps to the Netherlands, largely because of the establishment of brand loyalty in that country.

As was indicated earlier there has been relatively little government involvement in the potato processing sector and consequently the number of institutional factors affecting the sector have been relatively small.

As far as effluent disposal is concerned enterprises are charged according to their activity. Any processing activity would therefore pay a fee which was linked to the polluting power of the effluent and the quantity of effluent discharged.

There are specific regulations restricting the use of additives to potato products. For example in potato croquettes and dehydrated products there is a maximum limit of 0.3 per cent lecithins and mono and diglycerides. Potato flakes and granules are permitted only 100 mg/kg of sulphur dioxide.

* * *

To summarise, the modest sized Belgian potato processing sector has experienced many difficulties. Many of these difficulties have emanated from the problems of operating in a very unstable market situation. The market for potato products has developed only very slowly and processors have been buying raw material and selling potato products in very speculative circumstances. As a result there have been a number of

business failures and this has inhibited the development of the sector. The processing industry has had a relatively small impact on the potato production sector, largely because the major processor grows a large proportion of his own potatoes and also because a significant proportion of purchases of raw material are made from the Netherlands and/or France. There seems little likelihood that in the immediate future this situation will change significantly.

(vii) THE POTATO PROCESSING INDUSTRY OF ITALY

The potato sector

The potato sector of Italy shows a completely different evolution to that of any other country in the EEC. This difference arises because the potato has never been an important foodstuff in the same way as it has been in countries further to the north. The potato is a vegetable which grows better in temperate climates and the yields which can be achieved in Italy have been inferior to those in more northerly countries. Italians have consequently looked to other agricultural crops to provide the basis of their meals and in particular this role has been filled by various forms of pasta. In addition, because of its relatively low yield potatoes have never figured as an important feed for animals. Consequently the Italian potato sector has not experienced the rapid contraction which has been a feature of many of the potato sectors further to the north during the post war years.

Despite the relative lack of importance of the potato crop in Italy compared to other EEC countries, the size of the potato sector must not be underestimated. After the Second World War, potatoes were being grown on almost 400,000 hectares and potato production was just over 3 million tonnes. At this time Italy had the fourth largest area and production of the countries which are now the nine members of the EEC, and indeed it still holds this position today. During the 1950s the level of production was maintained and in the 1960s it increased slightly to almost 4 million tonnes, although during the 1970s production came down again to post-war levels and in 1977 was 3,147,000 tonnes. However, because of the very significant increase in yields over the period, the total area of potatoes contracted from an average of 392,000 hectares for the years 1951 to 1955 to 185,000 in 1977 (yields increased from 10 to 17 tonnes per hectare during the period).

Consumption per head of the population has remained around 40 kilograms per person per year since the early 1950s although it has declined steadily since 1970 and is now estimated to have fallen below 35 kilograms.

Italy is an important producer of early potatoes and these accounted for roughly 14 per cent of the total area grown in 1977. A total of 360,000 tonnes was produced in 1977 of which 151,000 tonnes were exported. The maincrop potato production in 1977 was 2.8 million tonnes and a small quantity of this (146,000 tonnes) was exported mainly to the southern areas of West Germany where a regular trade has developed. In addition Italy is also an important importer of maincrop potatoes and regularly imports between 200,000 and 400,000 tonnes each year. The most important suppliers are France and the Netherlands, although West Germany and Switzerland may also send substantial quantities.

Early potato production is concentrated almost exclusively in Campania, Puglia and Sicily. The production of maincrop potatoes is widely dispersed throughout the whole country and in comparison to many other European countries there is a marked lack of regional concentration of production. The largest concentration of production is in Campania which accounts for 17 per cent of the total maincrop potato area. This is followed by Abruzzo (12 per cent), Emilia-Romagna (8½ per cent), Veneto (8 per cent), Lazio (8 per cent) and Calabria (7 per cent).

According to statistics issued by the Commission of the European Communities, in 1976/7 total available supplies of potatoes other than earlies was 2.7 million tonnes (including imports of 248,000 tonnes). Of these, exports accounted for 9 per cent, seed use for 11 per cent (largely imported seed), human consumption 59 per cent and waste 21 per cent (14 per cent was used as animal feed). A very small proportion of supplies would have been used for processing into potato products for human consumption.

There are a wide range of varieties of potatoes being grown in Italy. The principal early varieties are Sirtema and Sieglinde and these account for a large share of the total early production. Among the maincrop varieties the most important is the round yellow fleshed variety Tonda di Berlino which in 1976 comprised 23 per cent of total maincrop production. The next most important in that year were Majestic (16 per cent), Kennebec (12 per cent), Bintje (8 per cent), Jaerla (8 per cent), Sirtema (7 per cent) and Bea (6 per cent).

There is very little information on the potato marketing system in Italy. However, a study of the situation in Emilia-Romagna in 1975 revealed that private supplies are important and account for 20 per cent of consumption in that particular area. Almost certainly the quantity available from private supplies in the whole of Italy will be much higher than this. The study of Emilia-Romagna also revealed that agents still play an important part in locating and assembling supplies on behalf of wholesalers. Because of the very dispersed production sector, trade between regions is relatively unimportant. Another feature of the marketing system is the importance of various forms of producer associations, which in Emilia-Romagna accounted for 22 per cent of supplies coming on to the market in 1975. The co-operative sector plays an important role in Italian agriculture. There have been a wide range of aids available for co-operatives which have enabled them to establish an important position in the potato sector, although, unfortunately, there are no statistics available which allow an assessment of the relative importance of co-operatives against private trade.

Compared to many of the potato sectors in the EEC, the Italian sector has changed relatively little since the Second World War. A major problem is the fragmented situation of production although there are no statistics which accurately define the structural situation in the potato sector. There still remain a large number of intermediaries concerned with the moving of the crop between producer and consumer and only in a very small number of specialised areas have more streamlined marketing channels begun to emerge. As one might expect a large potato processing industry is unlikely to have emerged from within such a potato sector especially when one considers the difficulties of growing and storing maincrop potatoes in the Italian climate and the much more limited demand. However a small industry has begun to emerge.

The manufacture of potato products

Because of the absence of any data on the potato processing sector of Italy it is very difficult to trace its development. The most developed sector of the potato products industry is the crisp sector. In fact, crisps began to be produced in Italy on an industrial scale as early as 1957 and had been available in a number of locations even before that. The first french fry factory appeared in 1967 although even today the industry is operating on a very modest scale. Until recently there has been no

manufacturer of dehydrated potato products in Italy; however in 1979 an integrated potato products plant was established which has a line for the production of dehydrated potato flakes. It is understood that the canning of potatoes has been regularly carried out by organisations involved in the canning of fruit and vegetables. However, because of the lack of any data it is difficult to track its development.

There are two major crisp manufacturers in Italy, Pai Alivar and San Carlo. Both of these companies have been producing crisps for some time. Apparently the founder of the San Carlo company began producing crisps on an artisan scale in Milan in the mid-1930s. They began producing on an industrial scale at the end of the 1950s, although there is some dispute as to which company was the first industrial producer of crisps. Pai Alivar, an organisation with a wide range of interests in the food sector, came into existence in 1957 and produced crisps from that date. Apparently there have been many small organisations which have entered the sector at one time or another over the years. Many of these organisations have been operating on an artisan scale and supplying very local markets. Because of the difficulties of distribution it is a major problem for an Italian crisp company to become established on a national basis. Whilst smaller firms have come and gone, Pai Alivar and San Carlo have steadily developed their businesses and only one other company Crick Crock has established an important market share. This latter company is located in Rome and serves that city and the south and cannot be considered to be distributing crisps on a national basis. Pai Alivar has two factories producing crisps, one, the largest, in Novara to the west of Milan and the other near Rome. The San Carlo factory is located at San Guilano south of Milan. A northern Italy location is essential as the bulk of demand is in northern provinces. It is estimated that the crisp manufacturers utilised something approaching 25,000 tonnes of potatoes in 1978/9. A very small quantity of crisps is imported into Italy, from West Germany and France. Usually these importations represent one of the larger Italian manufacturers supplementing their own production capacity through agreements with either a West German or a French company, and it does not amount to any outside challenge tc the position of the Italian crisp manufacturers.

The manufacture of french fries and other fried non-snack products is understood to have begun when a wholesaler (Pizzoli), situated near Bologne, began first frying and freezing a small quantity in 1967. Other organisations such as Rolli (located at Pescara), Golden Frites (Bolzano) and Alicom (Como) have since entered the market although none are very large. The latter company was originally producing chilled french fries but now is engaged in producing a unique product, french fries vacuum packed in aluminium foil. This product is not frozen but has a shelf life of several months at a temperature of 12-15^{o}C, and is seen as being of great appeal to smaller caterers because it is not necessary to have a freezer to stock it. It also was claimed to have a better texture than frozen french fries and an extra advantage was its speed of preparation (not being frozen). However the product is still at the development stage and is only being produced in relatively small quantities. More recently a large vegetable co-operative (CORAM) has installed a frozen french fry plant (again near Bologne) and the Agricultural Development Board for the region of Abruzzo has financed the establishment of an integrated potato processing plant which will produce frozen french fries, flakes and canned potatoes. These latter two organisations have a larger capacity than the private organisations within the industry. The total utilisation of potatoes by the Italian french fry sector is very difficult to assess because it is known

that some of the plants are operating at far from full capacity but it seems unlikely that more than 15,000 tonnes is being used per year. This market is strongly affected by imports and it is understood that supplies from the Netherlands and West Germany comprise a fairly major share of the market. Most of those operating in the sector tend to operate on a regional basis mainly because they are not operating on sufficient scale to cover the national market. It is understood however that the size of the market is increasing fairly rapidly as catering organisations are prepared to pay a premium for foods which reduce the cost of preparation in the kitchen with labour costs increasing rapidly. In addition more women are going out to work and consequently they are showing more interest in convenience foods.

Whereas in several other countries the dehydrated potato products sector has been contracting, it might seem strange to find a new integrated potato products factory in Italy extending the European capacity for potato flakes. This factory, located in the Fucino Basin, is understood to have begun production in 1979. In the Fucino Basin potatoes represent a very important crop and the processing plant was introduced not only to develop the possibilities of utilising potatoes but also to cope with some of the problems of over-production in the area. The factory is financed by the Regional Agricultural Development Board but the management will be entrusted to an agricultural co-operative. The plant has the capacity to utilise 30,000 tonnes of potatoes per year of which the dehydration line will take 15,000 tonnes (the french fry line will take 9,000 tonnes and the canning line 6,000 tonnes). Imports, particularly those from West Germany, play an important part in the Italian dehydrated potato market, although Canada, France, the Netherlands and Switzerland also regularly export to Italy. Between 4,000 and 6,000 tonnes of flakes and granules have been imported regularly over the last five years of which West Germany has accounted for between one-third and one-half. Dehydrated potato products are sold almost exclusively to caterers and the product is not sold at the retail level. It is understood that the principal brand is the Star Pfanni brand which is imported from Pfanni-Otto Eckart of Munich.

For their raw material supply both the crisp and the french fry sectors rely to a great extent on the importation of potatoes. The major problem for the Italian processors is obtaining raw material to keep them going throughout the year. It is very difficult to obtain reasonable quality potatoes after March as stores with the right facilities are not available and consequently any processor who wishes to process throughout the year has to rely on imports during a large part of the winter. In fact, because of their higher quality specifications the crisp manufacturers have greater problems than the french fry manufacturers in obtaining adequate quality potatoes from Italian sources. They suggest that it is almost impossible to get potatoes for crisping from Italy after December, or, if they are lucky, January. Consequently crisp manufacturers are forced to import from December onwards.

In the french fry sector it is important to distinguish the private processors from the co-operatives. It is normal for the private processors to purchase early potatoes on the free market, but later in the Italian season some arrange supplies on a contractual basis. The type of contracts will vary, although it is known that some manufacturers operate a kind of participation contract which allows the price to vary slightly in relation to the ware market price. The potato processors are either potato wholesalers or have strong merchanting connections, and consequently they take

the whole crop from domestic producers, grade out the larger potatoes for processing and sell most of the rest of the crop on the ware market. Supplies from other countries are usually negotiated around August or September for delivery later in the season.

Early in the Italian season the preferred variety for french fry manufacture is Primura and this gives good results. Later on, the variety Vivaks appears to be one of the most appropriate domestically grown varieties. This is a high dry matter content potato which, when grown in Italian conditions, gives a consistent product with acceptable colour and taste. It can also be produced at reasonable cost because it is a potato which crops well. Imported supplies later in the season comprise the variety Bintje.

There is a completely different attitude to raw material procurement on the part of the principal co-operative which is involved in the manufacture of french fries (CORAM). In fact this organisation holds an original philosophy to the entire business of manufacturing french fries. It takes potatoes from its members from the beginning of harvest in July through to January. During this period it processes as much as it possibly can until the supply of suitable quality potatoes runs out. The resulting product is kept in deep-freeze stores and sold from these throughout the year. The co-operative considers that domestically produced potatoes are better than imported supplies although in the past they have bought from other countries. They consider that Italian produced potatoes result in a much higher yield of final product, largely because of the higher dry matter content of the varieties which they use compared to Bintje (which is the most commonly available variety from other countries). In addition to Vivaks they also use Resy and Spunta. The co-operative considers it can produce its product at a much lower cost operating in this way because they are not tied to procuring more expensive Dutch, French or Swiss raw material. Undoubtedly one factor which has influenced the way in which they operate is the availability of quite substantial aids for the investment in the french fry plant. It is understood that 40 per cent of the investment was financed by subsidies of one kind or another and the other 60 per cent can be paid off over thirty years at a very low interest rate. As the co-operative is involved in the wholesaling of potatoes it simply takes its potatoes from its 1,000 members which produce potatoes and selects the processing potatoes from these. The co-operative maintains that they have few problems with variable quality even though they are drawing on supplies from many different producers. The farmer members of the co-operative are apparently free to grow which variety they want although the co-operative tries to influence the variety through advice and provision of seed.

The crisp manufacturers are purchasing larger quantities from other countries because of their more specific requirements in terms of quality and their need to continue production throughout the whole year. They begin the season from June to October by buying supplies from Italy, starting with production in Naples and then the Bologne, Verona and Piedmont areas. The crisp manufacturers buy potatoes from all over Europe depending upon the availability of the cheapest supplies. However, the largest organisation, Pai Alivar, has indicated that it has recently been purchasing more regularly from France, mainly because they prefer to establish close relationships with a number of exporting French co-operatives. Sales of Dutch potatoes to Italy have suffered because of the rise in value of the guilder. Rising currency values have also affected the sales of Swiss, West German and Austrian potatoes to Italian processors. The crispers use

a range of varieties but Bintje is the main imported variety. Other varieties which have occasionally been tried include Krostar, Prominent, Element and Maritta, all of which are conventionally classified as industrial varieties and underline the fact that the quality of Italian crisps is generally lower than in many other countries in the EEC.

Despite the reliance on imports, the crisp manufacturers would like to establish sources of raw material from within Italy as long as the quality is good. In fact, one company is actively pursuing a policy of developing closer links with Italian sources of supply and aims to raise the proportion it purchases domestically from 30 to 40 per cent.

Most of the companies buying potatoes from other countries would do so on the basis of RUCIP rules. Specification of dry matter content is rarely included in contracts as Bintje or other higher dry matter content varieties are always specified.

Unlike many other parts of the EEC there is a well established market for small packs, almost exclusively sold to children. This market is extremely competitive and the two main companies offer a wide range of attractions to children to persuade them to purchase their product. Toys in the bag seem to be popular, as are collecting series. The purchasers of large packets are usually housewives buying for family use.

The market for savoury snacks other than crisps is increasing although it is still very small in comparison to the crisp market. It is believed that none of the savoury snacks include dehydrated potato flakes or granules. No data is available to describe the development of the savoury snack market.

Distribution of a product such as crisps with a limited shelf life is a major problem in Italy because of the size and climate of the country. Consequently because of the problems of stock rotation control, food wholesalers can rarely be used. Direct selling to retailers is expensive, and is supplemented by selling through a number of organisations granted concessions.

Because of the small scale of the potato processing sector of Italy, institutional factors have had a relatively insignificant overall effect although the aids available for co-operatives have affected the competitive balance among domestic manufacturers.

In Italy there is a list of permitted additives and only additives on that list may be used in the foodstuffs specified. Sulphur dioxide is limited to 300 ppm for potato flakes and granules, and the emulsifiers mono and diglycerides of edible fatty acids to 0.4 per cent. The antioxidants, BHA and BHT are permitted to 0.003 per cent in flakes and granules and 0.003 per cent in fried potato products.

Water resource management is not organised on a national basis and special agencies have been made responsible for certain catchment areas or administrative regions. The method of charging for effluent disposal is not known. Processors exhibited a high level of concern over the problem of effluent disposal and some had invested in quite sophisticated treatment plants themselves without financial incentives from government.

* * *

To summarise, the small potato processing sector of Italy is quite different in character to that of other countries. This difference derives mainly from the problems of obtaining raw material from Italy throughout the year. Except for crisps, the Italian market for potato products is largely serviced by imports. These are competitive because the cost of the raw material in Italy, with its lower yields, and the difficulties of organising an efficient year round procurement system, make domestically produced output more expensive than comparable imported products. As suitable raw material is not available throughout a large part of winter and spring, processors either import raw material or close down. The latter alternative can only be adopted when the product can be stored and where government aids for investment have made full utilisation of plant capacity less critical. So far the potato processing sector of Italy has had little impact on the potato industry and it seems unlikely that the situation will change dramatically in the years to come.

(viii) THE POTATO PROCESSING INDUSTRY OF DENMARK

The potato sector

The area of potatoes grew steadily from 54,000 hectares at the beginning of the twentieth century to reach 90,000 hectares in the early 1920s. The potato sector contracted during the late 1920s and 1930s and by 1944 the area had declined to 65,000 hectares. During the war years the area was expanded to a level of 100,000 hectares but since then, in common with developments which have taken place in many of the other countries of the EEC, the area has declined considerably. In 1950, 105,000 hectares of potatoes were being grown in Denmark and the area was still 92,000 hectares in 1960; however during the next nine years the area contracted extremely rapidly to 33,000 hectares by 1969. During the 1970s the area has been maintained with even a slight increase in 1977 and 1978. In the latter year 35,000 hectares were grown. This period of rapid contraction in the potato sector has also seen a very large reduction in the number of farmers concerned with growing potatoes. In 1960 there were over a 100,000 producers growing potatoes (roughly 50 per cent of all farms) many of whom were involved in this crop on a very small scale. By 1978 it is estimated there were 17,000 growers of potatoes (only 14 per cent of farms) of which only 10,000 were growing potatoes on a commercial basis.

Although potatoes have been grown throughout Denmark there has always been a concentration of production on the island of Jutland, and in the province of West, North and East Jutland in particular. In the early 1920s, three-quarters of the potato area of Denmark was grown in these provinces. The contraction of the potato sector has led to slightly greater concentration of production in Jutland and also within Jutland itself. In 1977 87 per cent of the potato area was grown in Jutland and 50 per cent in the province of West Jutland. The county of Ringskobing in West Jutland alone, now accounts for 30 per cent of the total Danish potato area.

At the end of the Second World War the output of the potato sector was roughly 2 million tonnes but had fallen to around 1 million tonnes by the late 1970s, although the rate of decline in production has been uneven with quite substantial variations in output from year to year. Output has been roughly at this level since 1965/66, rising slightly higher in 1970/71 and then falling again during the 1970s to between 700,000 and 900,000 tonnes (except of course during the drought years of 1975/6 and 1976/7 when it dropped to around 600,000 tonnes). In 1977/8 and 1978/9 output increased again to the 1 million tonnes level.

One of the major reasons for the contraction in the potato sector has been the reduction in the use of potatoes for animal feed. During the 1950s potatoes were specifically grown for animal feed with often more than half of the crop being used for this purpose. The growing of potatoes for animal feed has slowly decreased and has now virtually ceased. Today potatoes are used for stockfeed only when they are surplus to ware requirements or when they are not suitable for the ware market. There has also been quite a substantial drop in demand for potatoes for human consumption. In 1960/1 potato consumption was 115 kilograms per person per year but by 1977/8 this has fallen to 65 kilograms per person per year. As in other countries increases in yield have also had an important impact on the area of potatoes grown. During the early 1950s yields were averaging 18 tonnes per hectare whereas in 1978 an average of 28 tonnes per hectare was being achieved.

The importation of potatoes takes place on a very small scale. These imports represent early potatoes which fill the gap between the exhaustion of old crop supplies and the new harvest. The quantity imported has increased substantially in recent years as the demand for early potatoes has increased, although even today they rarely exceed 25,000 tonnes.

In 1977/8 total available supplies represented 980,000 tonnes (including 25,000 tonnes of imports). Danish Ministry of Agriculture statistics showed that these supplies were disposed of in the following way: 34 per cent was consumed in fresh form, 30 per cent used by the potato starch factories, 9 per cent used as seed, 4 per cent for manufacturing alcohol, 2½ per cent was exported as seed and 20½ per cent represented waste (10½ per cent was fed to stock). However, market surveys conducted in 1978 have indicated that the statistics on the utilisation of supplies might well have been misleading in the past. They showed that almost 40 per cent of potatoes consumed in Dutch households comprised free supplies from private sources and hence the quantity of supplies from farms going for fresh consumption had been over-estimated and the quantity representing waste (some of which will be used as animal feed) under-estimated. Consequently the data on the utilisation of supplies has had to be quite drastically revised, and for 1978/9 (which had a similar sized harvest to 1977/8) it was estimated that only 18 per cent of total available supplies went into fresh consumption whereas waste was 39 per cent (stock feed represented 29 per cent).

As can be seen from the figures in the previous paragraph the starch industry is a very important feature of the Danish potato sector. It has been in existence since the beginning of the century but grew rapidly during the 1930s and the Second World War. Between the mid-1950s and the mid-1960s the quantity of potatoes used by the industry contracted. The quantity of potatoes utilised through the late 1960s and 1970s was very variable but the decline had been arrested. However, following Denmark's full entry into the EEC the industry has rapidly expanded so that in 1978/9 300,000 tonnes of potatoes were utilised, more than at any time during this century. The alcohol industry has also been an important outlet for potatoes although of much less importance than the starch industry. The utilisation of potatoes for the manufacture of alcohol grew slowly between the mid-1950s and mid-1970s and in 1977/8 the quantity of potatoes utilised for this purpose (37,000 tonnes) was higher than at any time since the mid-1950s. The manufacture of potato products for human consumption has been so small that they have not been entered separately in the supply balance sheet (see later).

Denmark is one of those countries in which Bintje has become the dominant variety for the ware market but no statistics are available to show the precise extent of its cultivation. Perhaps some indication of its overall importance is given by a recent consumer survey. This survey found that 80 per cent of consumers knew the Bintje variety, 60 per cent the variety Asparges and no other variety was known by more than 35 per cent of consumers. Special varieties are grown for the starch and distilling industries, of which the most important are Kaptah and Dianella.

The starch industry comprises six factories all of which are co-operatives. These co-operatives market their output through a central marketing organisation. The manufacture of alcohol is carried out by one organisation, De Danske Spritfabrikker (DDSF), which also holds a very important position in the small processed potato products for human consumption sector.

Altogether there are some 1,000 organisations registered to handle ware potatoes of which more than 600 are registered to pack potatoes. Many of these operate on a very small and occasional basis. The importance of co-operative organisations in the ware potato sector is difficult to assess because of the absence of statistics. However there are two large federal potato co-operatives which handle a substantial quantity of potatoes coming on to the ware market. It is known however that co-operative organisation of the ware potato sector is far less well developed than most other sectors of Danish agriculture. The seed sector has a stronger co-operative interest and also in this sector there is central organisation of the industry with the establishment of a Seed Potato Export Council, a single export marketing organisation and a seed potato guarantee fund. As in many other countries in the EEC, price instability is an ever present feature of the potato sector of Denmark. This has hindered the development of potato co-operatives and efforts are being made within the co-operative movement to try to introduce some greater stability into the industry by the more extensive use of contracts.

Prior to the entry of Denmark into the EEC, the ware potato sector of Denmark had been subject to some regulation by the operation of import controls. The import controls date back to the periods of protectionism within Danish history and given the relative geographical isolation of Denmark from the major potato exporting countries and the very high cost of transporting potatoes, the country has never really been in any great danger of being flooded with potato imports. Indeed since import restrictions on potatoes from EEC countries were lifted, the quantity of maincrop potatoes imported has been negligible. Restrictions on imports of potatoes from countries outside the EEC are still maintained during the period July to March. Apart from import controls the other major area of government involvement in the ware potato sector of Denmark has been measures to improve the quality of potatoes put on to the market. The Danish government has introduced quality standards for ware potatoes and licensed those organisations who trade in potatoes. It is illegal to sell potatoes other than through a registered packer or trader unless the total annual sales to consumers is less than 1 tonne. In addition a levy is charged on the industry and is collected through each of the authorised traders. This levy is used to promote better quality potatoes within the industry either through supporting State research and advice or through supporting a promotion and information service. The funds collected are also used to cover some of the costs of administering and controlling the quality standards scheme. It is widely acknowledged that the method of collecting this levy is inefficient as many of the potatoes put on to the market do not attract the levy.

The manufacture of potato products

The potato products sector of Denmark still remains very small and consequently there are very few statistics which describe its evolution and present day status. In fact the history of the potato products sector in Denmark is largely the history of one firm, De Danske Spritfabrikker which has at one time or another been involved in the manufacture of potato crisps, french fries and dehydrated potato products. Although a number of other firms have come into existence in recent years, it is necessary to concentrate upon DDSF in order to describe fully the history and present operation of the potato products sector of Denmark.

DDSF founded its first distillery in 1881 and in the following years it bought several other distilleries. During the First World War distillery businesses came under quite substantial threat because the Danish government restricted the utilisation of cereals for the manufacture of alcohol. In 1918 there was an agreement between the government, DDSF and another distillery which allowed them to rationalise the industry and the two major distilleries bought up all the smaller businesses. In 1923 DDSF bought up the other distillery and became a monopoly organisation under the auspices of the government. It has operated since this date on the basis of a series of 10 year agreements with the Danish government which impose certain restrictions on profits which can be distributed to shareholders, and controls over prices and margins. These 10 year agreements continued until 1972 and then the legal background of the monopoly disappeared with the entry into the EEC and the company became a free company. Up until this time there had been restrictions on imports and with entry into the EEC these import restrictions disappeared. The company began distilling potatoes at the end of the Second World War following restrictions on the use of cereals. From the very beginning they had grown potatoes on the basis of contracts with growers and established an experimental and research programme to try to improve the suitability of potatoes for the alcohol industry.

At this time the contract prices paid to growers were the same as those being paid for starch potatoes by the starch potato factories. But during the 1950s the potato alcohol industry found itself under considerable pressure because it could not produce alcohol competitively from potatoes at these prices. This gave the company every incentive to look for other possible utilisations of potatoes. The company realised it had the advantage of very close relationships with producers over a fairly long period of time and the experience of dealing with producers on contracts. It also had the skills and expertise of handling potatoes and consequently it seemed a natural extension of its interests tc begin the manufacture of potato products for human consumption. Consequently in 1959 the company established a crisp factory. This was the first time that crisps had been manufactured industrially in Denmark, although they had been produced on an artisan scale for a number of years. Later, in 1965, the company began production of french fries and dehydrated potato products. The company still manufactures french fries today but stopped producing dehydrated potato products in the early 1970s (although they still maintain an interest in these products through importing).

In the crisp sector DDSF has two major competitors. They are Kim Chips, which is owned by the Danish Fancy Food Company, and Give Chips. It is understood that in 1978 DDSF accounted for something like 90 per cent of the crisps sold on the Danish market and Kim Chips was their most important competitor. In addition, there are a number of very small organisations selling potato snacks including one of the potato starch factories which produces potato snack products from reconstituted dehydrated potato. Official statistics on the quantity of potatoes used for the production of crisps and french fries are available although it is doubtful if they are fully comprehensive. They reveal a total utilisation for the two groups of products of 8,000 tonnes in 1967 and 15,000 tonnes in 1970 of which the vast majority is used for crisp manufacture. Since that date there appears to have been very little growth in the quantities used and in 1977/8 the throughput of the industry was very similar.

In the french fry sector DDSF are estimated to account for roughly 50 per cent of the market with their principal competitors, Sanalco, accounting for 30 to 40 per cent. These are the only two companies manufacturing frozen french fries, although there are a number of smaller companies who are producing fresh or chilled french fries. Sanalco are understood to have entered the french fry sector a little before DDSF. Give Chips also manufacture a small quantity of french fries.

There are no organisations producing dehydrated potato products in Denmark today. DDSF ceased the manufacture of dehydrated potato products because it found it very difficult to be competitive. Today the company imports from Sweden and the United Kingdom and packs the product in Denmark.

A very small quantity of potatoes are canned by vegetable canners operating in Denmark. The quantities involved have been less than 2,000 tonnes during the 1970s and in 1977 and 1978 production almost ceased.

The total quantity of potatoes being utilised for potato processing in Denmark is extremely small. On the basis of trade estimates it seems unlikely that the total quantity processed in 1978/9 exceeds 20,000 tonnes in all the different potato processing sectors.

As DDSF is the dominating company producing potato products for human consumption in Denmark its mode of operation will be discussed in more detail. The original DDSF crisp factory was located at Hobro in central Jutland, in an area where potatoes are available from farmers who are growing on sandy soils. This factory was located south of the company's distillery at Aalborg which draws potatoes mainly from the clay soils immediately around the factory. However, in 1978 the manufacture of crisps and french fries was moved to the location of the distillery where it was considered that there would be advantages in a single location (although raw material supplies were drawn from the sandy soil areas around Hobro). In particular it meant that the company could take the whole crop from farmers and that those potatoes not needed for the manufacture of french fries or crisps could be diverted for use in the alcohol plant. In addition the starch in the waste water from potato product manufacture could be recovered and used in the distillery. The other companies involved in the manufacture of potato products handle such small quantities of potatoes that a location in potato production areas is hardly essential.

DDSF purchase almost all of their supplies of raw material on contract and only buy on the free market in an emergency (this is also understood to be the policy of the other potato processing companies). They have had to adopt this policy because the availability of suitable quality supplies on the Danish ware market cannot be assured. Buying on contract gives the company the opportunity to influence the production methods of its suppliers so that the potatoes are suitable for processing. The company has taken some of the responsibility for the production of good quality potatoes by carrying out over the years a fairly intensive educational and advisory campaign involving its own field staff. In order to assist farmers the company has produced a detailed manual on the production of potatoes destined for crisp or french fry manufacture.

Crisp consumers in Denmark, like most of Europe, prefer a lighter coloured product although there is a small group of Danish consumers who demand a stronger tasting, browner crisp. However, Denmark is virtually at the northern limit for the production of suitable quality potatoes for light

coloured crisps (or french fries) because of climatic reasons. Often the temperature during the harvest period in the autumn can be very low, and if it goes below 7°C this can produce very high sugar levels in the tubers. In Norway, Sweden and Finland processing companies have very severe problems with sugar levels and despite using every possible method of controlling colour, a darker coloured product is inevitable. As a result of the problems of sugar levels the company has taken full responsibility for all storage as this is critical to control of sugars. All potatoes are stored in the company's own stores.

To overcome the problem of sugars DDSF prefer to use the variety Saturna, although Bintje is considered to have a much better taste and is less subject to bruising and damage because it has a lower dry matter content. Consequently Bintje tends to be used early in the potato season when the temperature is not normally below 7°C. The rest of the season the company processes Saturna which is stored in their own storage facilities and therefore can be kept right through to the end of July. Environmentally controlled storage systems maintain temperatures at above 6-7°C and re-conditioning is practised before processing. The company had sole rights to use Saturna on the basis of an agreement with the Dutch breeder's agents, Agrico; however this has recently been cancelled by the Danish monopoly authorities as other companies wanted to use the variety. Access to Saturna may well have helped DDSF maintain their dominant position in the crisp market because this meant that they were the only company which could maintain a good light coloured product. The other companies resorted to less suitable varieties which produce problems of colour more often.

When the company first commenced the manufacture of french fries they used only Bintje. This was satisfactory whilst they used Bintje for crisp manufacture but when they moved over to utilising more Saturna for crisps there was every incentive to use this variety for french fries as well. The major problem with using Saturna for french fries has been an inferior taste compared to Bintje-prepared french fries, although the company now feels that they have the facilities within their new factory to improve the quality of the Saturna-based french fry product.

In total the company has something like fifty farmers supplying potatoes for food processing. The company has selected its farmers very carefully and have only offered contracts to those farmers whom they considered to be good growers, have a positive attitude to producing agricultural products for processing and are willing to invest in the necessary machinery to provide a good quality raw material. The growers must also be located on soils which produce a good quality processing potato, particularly soils which are fairly light. Because of this all the farmers who are supplying potatoes to the crisp and french fries factory have had to invest in irrigation facilities in order to maintain quality. The company prefers farmers with at least 5 hectares of potatoes per farm and this represents a fairly large potato enterprise in Denmark. It was felt that farmers operating on this scale are large enough to consider seriously investing in the right equipment and to consider the crop from a professional point of view.

In a sector where prices on the ware market are variable it is very important that farmers who supply the factory on contracts have the right attitude and discipline. To a certain extent the existence of a starch potato industry in Denmark has helped farmers to understand the advantages of selling their output on contracts and to value the establishment of

stable relationships with an important buyer such as DDSF. Indeed the company maintained there are many farmers who would like to supply them with potatoes. The contracts are revised annually although they are always entered into on the assumption that they will last for many years. The company has the freedom to turn down farmers if they continually fail to produce the right quality raw material. The contracts are usually made in December or January and the prices are calculated on the basis of average ware potato prices. The average quoted price is reduced slightly to account for the fact that the contract covers the entire field run crop, the company pays for the transport and also carries out storage. The company deals directly with individual farmers although an organisation has been established to represent all producers who sell to DDSF. This organisation was initiated by the producers themselves but its existence is encouraged by the DDSF and the company makes a contribution towards the administration of the organisation and may carry out a number of services on its behalf.

The contract lays down minimum quality standards and each consignment is tested upon arrival at the factory. Tests of dry matter content, sugar levels and defect and damage levels are taken and potatoes are rejected if the test results are unsatisfactory.

The market for crisps is estimated to be in the order of 3,300 tonnes per year which represents something like 650 grams per head of the population. It is understood that demand increased fairly steadily through the 1960s but has grown relatively little through the 1970s, probably because of a slow-down in economic growth. Plain crisps dominate the market and flavours are relatively unimportant as are sticks. Small packs are virtually non-existent and this underlines the different market characteristics compared to the United Kingdom where a much larger demand is obvious. Apparently when crisps were first introduced in the Danish market they were used in meals but now they are increasingly being used as a snack product. There has been relatively little progress with new snack products based on maize flour or dehydrated potato flakes or granules, although DDSF have introduced a product called Chipso which is produced at the Bahlsen/ Flessner factory in West Germany; (the product sells under the 'Chipsletten' brand in West Germany). Imports of crisps are non-existent despite the proximity of the West German border. Transport costs are believed to be an important factor constraining the development of imports, although the major manufacturer admits that it occasionally has to adjust its prices to prevent competition from imports. Exports of crisps are also very insignificant. Most exports go to other Scandinavian countries where DDSF has other interests.

DDSF do not have sufficient volume of output to justify the maintenance of a full-time sales staff and consequently they sell through traditional grocery wholesaling channels. However, at one time they were forced to make regular visits to retailers because of aggressive sales strategies on the part of some of their competitors on the crisp market.

French fries are a relatively recent innovation in Denmark but during the last five years demand has increased at a fairly rapid rate particularly among small catering establishments. The first of the fast food chains, which are common in many other countries in western Europe, has recently opened its first outlet in Denmark and this may help to accelerate demand for french fries.

Oven prepared french fries have recently been introduced onto the market by DDSF and they are also imported in small quantities. The extent of imports is not known because no trade statistics exist. They are understood to vary quite considerably from year to year and the principal source is the Netherlands.

The market for dehydrated potato products is also very modest in the Netherlands. Apparently there is a very strong resistance to these products on the part of Danish consumers, who prefer fresh potatoes. Potatoes have always been the cheap part of the meal and consequently there is a quite high level of consumer resistance to a more expensive product despite its greater convenience. Exports of flakes and granules have consistently exceeded imports, even in the years when there has been no domestic production, this results from a number of companies trading in dehydrated products As a result it is impossible to assess the market size. There is no trade recorded in dehydrated potato pieces.

Effluent disposal represents a problem for most of those concerned with the manufacture of potato products although in Denmark one is never all that far away from the coast where disposal of effluent is much easier.

In Denmark standards of composition of foods are laid down for certain groups of products. In addition a list of additives permitted for inclusion in foods came into force in July 1978. Potato products are included under the heading 'fruit and vegetables and their products'. Sulphur dioxide is limited to 100 ppm and the antioxydants BHA and BHT to 0.005 per cent.

* * *

To summarise, the potato processing industry is still very small and is dominated by one major firm. Consequently the industry has had very little impact upon the Danish potato production sector. However, potato product markets are expanding and the relative importance of processing will continue to increase. Many of those operating in the Danish potato production sector accept the advantages of contractual relationships with processors and this facilitates relatively straightforward raw material procurement methods.

SECTION VI: GENERAL COMMUNITY ISSUES

The foregoing description of the problems of the manufacturers of potato products and the industries in each of the Member States raises a number of general issues which warrant official consideration at the Community level.

First, there are a number of national measures which have the effect of distorting competition and which influence the competitiveness of the manufacturers in a number of countries. These affect either the levels of costs incurred or the quality of product. Although none of these distortions appear to seriously discriminate against the interests of any country, harmonisation of these measures would be to the industry's overall benefit.

Second, there is the question of the need for meaningful minimum quality standards for potato products in the Community. The Union Européene des Industries de Transformation de la Pomme de Terre (UEITP) has already submitted proposals to the Commission for minimum quality standards. The rationale for such measures is the facilitation of trade in these products throughout the Community and protection for the consumer.

Third, there is the issue of the need for an overall grading scheme for french fries in the Community which will facilitate trade and acknowledge the different quality requirements of various types of purchasers. The United States Department of Agriculture has operated such a scheme since 1954.

Fourth, there is the problem of third country imports into the Community. These affect the dehydration industry principally, although the french fry industry is also subject to some third country competition. As some of this competition comes from East Europe (flakes and granules, dehydrated potato pieces and french fries) there is a clear need to establish if this competition is fair. The effect of North America's competition has been very important even with a tariff barrier of 18 per cent.

Fifth, there is the relationship with the potato production sector. A Regulation for the common organisation of the potato market has been proposed and has been under discussion for several years without much sign of success. The eventual shape of this Regulation and its impact on the potato sector will have some effect on the potato products industry.

National measures

Generally speaking the potato processing industry has progressed with relatively little intervention from official sources. Although, like all industries it is subject to a whole series of measures which are taken by national governments in pursuance of their own domestic economic or social policies, and unless more convergent policies or goals are pursued by Member States, this will continue to be the case. The impact of these general national economic and social policies on the competitive position of manufacturers is largely outside the scope of this study. However, whilst the Commission is well aware of their effect on competition, it is important to underline how certain national measures can directly affect

an individual sector. In particular the availability of location or development grants for new factories has had an important effect on the potato processing industries of several Member States. These have influenced the location of some industries and a number of manufacturers who have built new plants during the 1960s and 1970s have benefited from them. Another example of the influence of national measures applies to pollution and water charges, although in this case it is difficult to establish precisely which manufacturers are worst affected, because the methods of calculating pollution costs are very complicated and there are wide differences within any given country due to the autonomy of a number of regional or area water resource authorities. Certainly some manufacturers feel that they incur higher costs (or have had to invest heavily in treatment facilities) because of their location and that this represents an important distortion of competition (although the magnitude of the distortion must not be exaggerated). Clearly, it would be wrong to harmonise maximum levels of permitted pollution because the needs of different regions would vary quite considerably. However, there may be ways in which measures such as controls, methods of charging, costs, etc. could be harmonised to at least reflect Community rather than national priorities. National aids for pollution control obviously distort competition.

National aids for the potato sectors of the nine Member States also represent an important area of institutional intervention which have affected competition; however these will be discussed later.

Specific national aids for cooperatives represent another important area where competition could be distorted, although for a number of reasons, only a few cooperatives are involved in potato processing. Aids for cooperatives have been particularly important in France and Italy and it is no coincidence that most cooperative manufacturers are found in these countries (particularly France).

It should be noted that occasionally when working in the potato industry of Europe, one encounters rumours that aids for the Dutch potato sector contribute to making Dutch products (particularly french fries) very competitive on the European market. However, when pressed, no-one can ever produce any firm evidence of such aids being given and, although the author has not set out specifically to identify them, it seems most unlikely given the overall philosophy of the Dutch potato and potato products industry. It seems more reasonable that such rumours derive from the genuine competitiveness of Dutch products.

Minimum quality standards

Another important area of responsibility which has largely been left to national measures in the past, is the establishment of rules covering the use of chemical additives. The separate national standards operate as an inconvenience for the sector as a whole, especially for those products in which there are substantial levels of international trade. Some measures to harmonise regulations concerning food additives have been taken by the Community although Member States still retain a certain autonomy in the matter. In addition, the establishment of minimum quality standards covering potato products may be needed for inclusion in the Regulation for the common organisation of the potato market. It has been

proposed that these quality standards will include maximum levels of additives and the UEITP has forwarded proposals to this effect to the Commission for consideration.

The establishment of minimum quality standards is an issue about which there is not universal agreement. Some manufacturers believe that there should be no minimum quality standards (apart from maximum levels of additives) as consumers demand a wide range of qualities, and some may be prepared to pay for, and receive satisfaction from, a lower-priced, lower quality product. They point out that the consumer has the ultimate sanction in the matter by discarding a product which she does not like in favour of a product she does. Some manufacturers also point to the problems of maintaining minimum standards from year to year given that environmental factors may affect the quality of the raw material which is used. However, there is a case for consumer protection. No consumer should be exposed to additives in levels which may damage their health, buy any product which could expose them to some danger (as is the case of french fries with high water content which might cause hot fat to spatter), or buy something which is of poor quality when that quality is difficult to gauge upon purchase. As far as crisps are concerned, a fair assessment of quality can be made when the consumer buys the product, for she can see from the bag whether or not the product has crumbled and she can easily assess the colour. Even if the product is not liked (as may be the case with a new flavour) the cost of her unsuccessful trial purchase is not particularly large. However, it is easy to see how consumers who buy products which need further preparation, such as instant mashed potato or french fries, may feel more let down if the quality of the product is poor. Consumers buying these products are not in a good position to make an assessment of quality upon purchase and it is only after spending time in preparation that they can make any assessment of quality. Consequently if a consumer experiences this kind of dissatisfaction, it is highly likely it will be detrimental to the long-term interests of manufacturers and hence within the sector there is a strong body of opinion which is in favour of minimum quality standards. The UEITP has therefore submitted proposals to the Commission, although the proposed minimum levels of quality standards are pitched at a fairly modest level so that consumer choice is not restricted too much.

System of grading standards

The issue of introducing a range of different grading standards as well as a minimum quality standard only has relevance to the french fry sector. The introduction of grades in the United States derives mainly from the demands of the market. It was recognised that different qualities were demanded by different users and rather than have a large number of customers issue many different specifications, some of which differed only marginally, the United States Department of Agriculture, in response to the requests of the industry, specified different grades which could be used. As these grades were introduced into the United States' industry at a fairly early stage in its development they were easily assimilated. However, the introduction of such a system into the European industry given its current state of development could present problems. In particular, a number of organisations have taken specific commercial advantage of the fact that there is no official grading scheme to put forward their own range of standards. Consequently it is very difficult

for them to see any advantage in the introduction of an official grading scheme. This not only applies to commercial organisations, for certain countries have also considered putting forward their own high quality specification to gain advantage for all manufacturers in that country who maintain those standards. That aside, some manufacturers see advantage in an official scheme. In particular it would simplify the problems of a number of manufacturers who are constantly having to adjust their processes to meet minor differences in buyer's specifications, and it would facilitate trade as any buyer could specify the official grade which best meets its requirements. Even with a grading system there are bound to be some buyers who would need to write their own specifications but a large number would find their needs met quite adequately by intelligently written standards. On balance, because of the problems of introducing such a scheme it is perhaps not an issue of high priority. However, as the industry progresses it seems likely that more organisations will establish their own specification and the industry may well reach the stage when such a scheme will deserve more urgent consideration.

Imports from Third Countries

The importation of potato products from Third Countries represents a very serious problem, particularly from the point of view of the manufacturers of dehydrated products. This report illustrates the impact of Third Country competition although it must be said that not all manufacturers seem to have been hit to the same extent. The West German industry for example, has not had to adopt drastic changes in its mode of operation in order to cope with increased levels of competition although they are just as concerned about the problem.

The problem, and its possible causes, has been discussed in some detail elsewhere in this report (see Section IV). It has been suggested by several persons in the industry that the introduction of minimum quality standards may limit the importation of dehydrated products. However, in view of the kind of dehydration equipment which is known to be available in certain parts of Eastern Europe as well as in North America it would appear that minimum quality standards could only have a minimal and at best short-term effect. One major problem is the consolidation of import tariffs in the General Agreement on Tariffs and Trade (GATT) and the consequent limitation on unilateral action on the part of the Community unless dumping can be proved. There exists within the framework of the proposed Regulation on the common organisation of the potato market a facility for amending the Common External Tariff should it be necessary, but again the GATT obligations cannot be ignored. Perhaps the Community's greatest need is for a thorough understanding of the long-term competitiveness of the European industry in comparison with North American and certain East European industries. Improved understanding of the operation of these industries would enable the Community to be in a better position to assess future policy requirements.

The potato sector

In view of the commitment in the Rome Treaty to introduce common policies for all agricultural products the issue of the relationship between the processing sector and the potato production sector is an important area of Community responsibility. There have been wide differences between the Member States in terms of their national potato

sector policies. In some countries national policies of market regulation have been enforced which have involved large sums of money being channelled towards the potato sector in order to support producers' prices (e.g. the United Kingdom and France). In other countries the existence of certain national laws facilitate the organisation of a potato sector in a particular way. For example, certain countries have the possibility of compulsorily and legally extending rules to an entire commodity sector (e.g. the Netherlands and France) or to a part of that sector (e.g. the Netherlands and the United Kingdom). These powers have enabled actions to be taken in these countries which could not be contemplated in others. In contrast some Member States have been virtually without any kind of regulations covering their potato market.

The possibility of maintaining producers' prices above the levels pertaining in other countries has been severely limited by the Charmasson judgement in the European Court of Justice which made quantitative restrictions on EEC trade in agricultural products illegal, even if they were not covered by a common Community regime. The support of prices is therefore only possible if transport costs between any of the countries are significant (as applies between EEC mainland, the United Kingdom and Ireland). In this case there is some potential for price support up to the point at which it would be economic to transport potatoes into the country.

National measures which are meant to aid the potato sector by supporting producers' prices can work against the interests of manufacturers located in that country. Measures which force up raw material prices raise the product prices of these manufacturers and their competitive position can be affected. In Great Britain the Potato Marketing Board operated a scheme for maintaining producers' prices (with the help of a government ban on the import of potatoes) which occasionally put pressure on some of the processors' markets. This was recognised by the granting of aids to the manufacturers at times when difficulties have resulted from actions to support prices. In a similar way the new 'stabilisation' scheme which has been operated in the United Kingdom to cope with free trade conditions, could operate against processors' interests if it is managed with regard only to raw material transport costs.

Stabilisation schemes were introduced into the proposal for a Regulation for the common organisation of the potato market in 1978, although not on the same basis as operated in Great Britain (the proposals contain the provision that such schemes should be financed exclusively by the producers, and cannot be made obligatory). On this basis it is doubtful if an effective scheme could be operated and consequently the manufacturers' interests cannot be discriminated against. From the point of view of manufacturers in all countries it is important that competition within the Community is fair and that all manufacturers are operating on the same basis with respect to the purchase of their principal cost of production; on these terms they are keen to see a common potato policy introduced.

As was seen in Section V some attempts have been made to influence the relationship between the manufacturers and their suppliers. These cover a number of issues including the contractual relationships (France) and a formal system of payment on the basis of quality (the Dutch french fry industry). In the former case the perceived need for action arose out of

concern at contractual relationships whereas in the latter case the system was proposed to improve the quality of potatoes coming forward to the french fry plants. The efforts with respect to the latter case are only applicable to the Dutch system with its relatively simple potato marketing system comprising a single variety and a comparatively limited range of environmental conditions. The former case is much more relevant to circumstances throughout the Community. In all Member States there has been cause for concern over relationships between producers and processors in the past, especially during the drought years of 1975/6 and 1976/7 when all contractual arrangements came under great pressure. This remains an important issue although it is highly doubtful if any Community action could provide any solution or indeed would be desirable. Much more satisfactory is that the interests concerned will solve these problems themselves on a factory by factory basis. There are reasons for being optimistic about the industry's ability to resolve such problems itself. In particular it is to the mutual advantage of all sides to work harmoniously together and this acts as an important force within the industry. In addition, as the processing industry develops and contractual relationships become more important so more sophisticated negotiating and contractual systems will emerge. This is the way in which the United States industry has evolved and there is already evidence of such systems developing throughout the EEC. Where this has been the case there is also evidence that all parties will become more aware that the sector can only prosper when the manufacturer and its suppliers work closely together. It cannot be in the interests of the manufacturers to exploit their suppliers in any way as they need continuity of supply of suitable raw material. Similarly, it cannot be in the interests of growers to renege on contracts if they wish manufacturers to continue to be successful in markets and to continue to offer them a profitable outlet.

* * *

Concluding remarks

The potato processing sector of the EEC, manufacturing at least 2.9 million tonnes of potatoes represents an extremely important feature of the potato industry. Indeed in each country of the Community it is the only sector of the potato industry which is growing, and the rate of growth in some sectors remains considerable. The concept of a single Community market is realistic as international trade in potato products is an important feature (even in the crisp market, with its higher costs of transport, there are some very significant flows between countries on the mainland of the EEC). However with this single Community market the areas of official action which are required are very modest and the industry has shown in the past how it can overcome its problems by its own resourcefulness. The main requirement of the industry therefore is that it should be allowed to continue to operate as freely as possible so that the necessary initiatives can be taken. In addition, as can be seen above, there are a number of areas where certain actions will assist the overall development of the processed potato products sector.

BIBLIOGRAPHY

Adler, G.; Kartoffel und Kartoffelerzeugnisse; Paul Parey, Hamburg, West Germany; 1971.

Agra-Europe - Potato Markets, various issues; Agra-Europe, Tunbridge Wells, Kent, United Kingdom.

Agricultural Co-operation and Marketing Services Ltd.; A review of potato processing and supply; unpublished report; 1978.

Alvisi, F. and Lunati, U.; La patata, produzione e mercato in Emilia-Romania; Italia Agricole, vol.113, no.178, pps.23-42, 1976.

The British Food Manufacturing Industries Research Association; Overseas food legislation; BFMIRA, Leatherhead, United Kingdom; 1979 update.

Burton, W.C.; The potato; H. Veenman and Zonen N.V., Wageningen, The Netherlands; 2nd edition; 1966.

Burton, W.C.; The potato; Chapman and Hall, London, United Kingdom; 1st edition; 1948.

Central Council for Agricultural and Horticultural Co-operation; Potato marketing - a strategy; CCAHC, London, United Kingdom; 1979.

Centre Français du Commerce Extérieur; Le marché des légumes frais et pommes de terre en Italie, étude de la concurrence et recherche de débouchés; CFCE, Paris, France; 1975.

Centre Français du Commerce Extérieur; Les produits transformés dérivés de la pomme de terre en Belgique; CFCE, Paris, France; 1973.

Centre Français du Commerce Extérieur; Les produits transformés dérivés de la pomme de terre aux Pays-Bas; CFCE, Paris, France; 1974.

Clevering Lombardi, L.; Les produits dérivés de la pomme de terre; Informations Internes sur l'Agriculture, 133; Commission of European Communities, Brussels, Belgium; 1974.

Deutsches Tiefkühlinstitut eV; Die Tiefkühlwirtschaft in West-Europa im Jahre 1977; Cologne, West Germany; 1978.

Deutsches Tiefkühlinstitut eV; Die Tiefkühlwirtschaft in der Bundesrepublik; Cologne, West Germany; 1978.

Dykes, W.R., Editor; Report of the international potato conference, November 16th-18th 1921; Royal Horticultural Society; 1921.

Economist Intelligence Unit; Potato crisps; Retail Business, no.191, January 1974; EIU, London, United Kingdom.

Economist Intelligence Unit; Potato crisps; Retail Business, no.243, May 1978; EIU, London, United Kingdom.

Economist Intelligence Unit; Savoury snacks; Retail Business, no.244, June 1978; EIU, London, United Kingdom.

Economist Intelligence Unit; Dry and savoury snacks in France; Marketing in Europe, no.158, January 1976; EIU, London, United Kingdom.

Economist Intelligence Unit; Savoury snacks in the Netherlands; Marketing in Europe, no.167, October 1976; EIU, London, United Kingdom.

Economist Intelligence Unit; Potato products in the Netherlands; Marketing in Europe, no.194, January 1979; EIU, London, United Kingdom.

Gould, W.A.; Quality assurance manual for the manufacture of potato chips and snack foods; Potato Chip/Snack Food Association, Euclid, Ohio, United States; 1976.

Harris, M., Editor; The potato crop, the scientific basis for improvement; Chapman and Hall; London, United Kingdom; 1978.

Howard, H.W.; Factors influencing the quality of ware potatoes. 1) The genotype; Potato Research, vol.17, pps.490-511, 1974.

Hughes, J.C.; Factors influencing the quality of ware potatoes. 2) Environmental factors; Potato Research, vol.17, pps.512-547, 1974.

International Tin Research and Development Council; Historic tinned foods; Publication no.85; 1939.

The Irish National Prices Commission; The quality of potatoes; Occasional paper no.25; The National Prices Commission, Dublin, Ireland; November 1977.

Der Kartoffelbau, various issues; Hamburg, West Germany.

Kartoffelwirtschaft, various issues; Hannover, West Germany.

Komp, Dr.P.; Regional Entwicklungstendenzen des Kartoffelbaues in der Bundesrepublik Deutschland; Doctoral dissertation; George-August-Universität, Göttingen, 1974.

Leeuwen, J.J.; Contractteelt van aardappelen voor Nestlé op de zuidelijke zandgronden; Bedrijfsontwikkeling, vol.4, part 2, pps.165-167, 1973.

Libre Service Actualité; Les dérivés de la pomme de terre; LSA, vol.18, no.544, 1975.

Libre Service Actualité; Préparations à base de la pomme de terre; LSA, vol.21, no.678, 1978.

van Loon, C.D.; Kwaliteitsverbetering van consumptie-aardappelen; Proefstation voor de Akkerbouw en de Groenteteelt in de Vollegrond, Lelystad, The Netherlands and Produktschap voor Aardappelen, the Hague, The Netherlands; February 1979.

Lugg & Gould Ltd.; Potential uses for outgrade potatoes; unpublished report; 1978.

Marché international de la pomme de terre, various issues; Centre Française du Commerce Extérieur, Paris, France.

Mercier, A.; Conditions economiques et techniques de la transformation des pommes de terre de consommation; Rapport de stage, Omnium d'économie agro-alimentaire, Rungis, Paris, France; 1972.

Meyer, Dr.R.; Kooperation beim Speisekartoffelabsatz, Doctoral dissertation; Rheinische Friedrich-Wilhelms-Universität, Bonn, 1977.

Potato Marketing Board; Potato processing in Great Britain; PMB, London, United Kingdom; 1974.

Potato Marketing Board; Potato processing in Great Britain; PMB, London, United Kingdom; 1976.

Potato Marketing Board; Potato processing in Great Britain; PMB, London, United Kingdom; 1978.

Processed Vegetable Growers' Association Ltd.; annual report 1977/8; 1978.

Produktschap voor Aardappelen; Annual report, various years; The Hague, The Netherlands.

Raskin, V.J.; The European fast food market; Dean Witter & Co. Inc., New York, United States; December 1976.

Raskin, V.J.; An update on the European fast food market; Dean Witter & Co. Inc., New York, United States; November 1977.

Salaman, R.N.; The history and social influence of the potato; Cambridge University Press, Cambridge, United Kingdom; 1949.

Smith, O.; Potatoes: production, storing, processing; Avi Publishing Company, Westport, Connecticut, USA; 2nd Edition; 1977.

Smith, P.E. and Young, N.A.; The West German potato marketing system; Report No.11; Centre for European Agricultural Studies, Ashford, Kent, United Kingdom; 1979.

Statistiches Bundesamt; Fachserie 4, Produzierendes Gewerbe, Reihe 3; Wiesbaden, West Germany; 1978.

La Surgelation; Rapport Statistique, various years; FICUR, Paris, France.

Talburt, W.F. and Smith, O.; Potato Processing; Avi Publishing Company, Westport, Connecticut, USA; 3rd Edition, 1975.

Vandenhende, J.; Transformation: nouvel accord interprofessionnel national; La pomme de terre Française, no.394, November/December 1979.

Vereniging voor de aardappelverwerkende industrie (VAVI); Jaarverslag, various years; VAVI, The Hague, The Netherlands.

Wer und Was in der deutschen Obst-, Gemüse-und Kartoffelverarbeitenden Industrie; B. Behr's Verlag, Hamburg, West Germany; 1978.

Young, N.A.; The Dutch ware potato marketing system; Report no.9; Centre for European Agricultural Studies, Ashford, Kent, United Kingdom; 1977.

Young, N.A.; The French maincrop potato marketing system; Report no.10; Centre for European Agricultural Studies, Ashford, Kent, United Kingdom; 1978.

Zentrale Markt-und Preisberichtstelle für Erzeugnisse der Land-, Forst-und Ernährungswirtschaft; Bilanz Kartoffeln, various years; ZMP, Bonn-Bad Godesberg, West Germany.

APPENDIX I

THE LOCATION OF MANUFACTURING PLANTS

NOTES TO THE MAPS

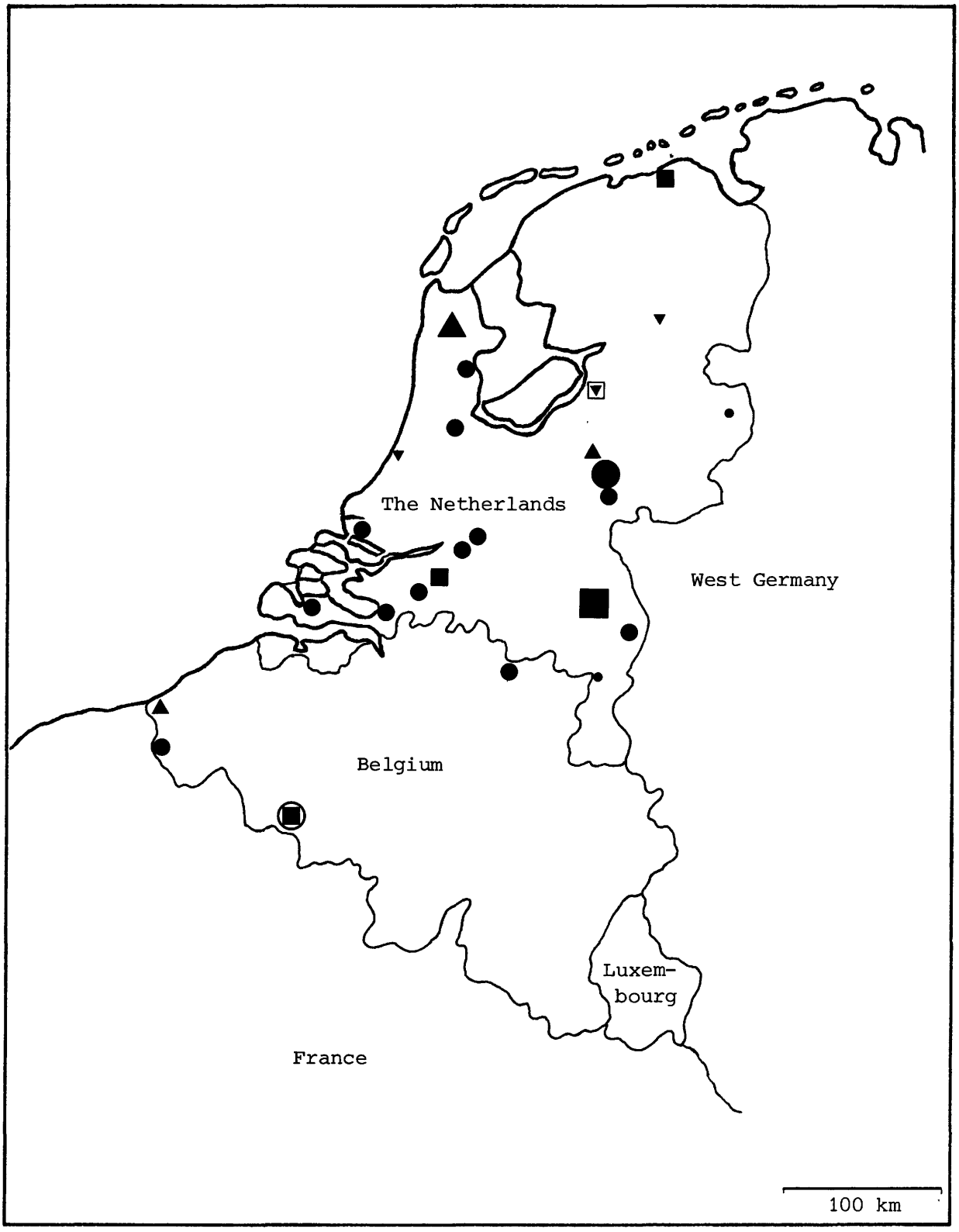
The main purpose of the maps in this report is to give the reader some indication of the distribution of the main points of utilisation of potatoes for the manufacture of products for human consumption. Clearly, to give a realistic picture of the importance of potato processing to different areas it is important to provide an indication of the quantity of potatoes being utilised at each plant. However, there are many difficulties in producing such a map. Some organisations are naturally anxious to preserve confidentiality and the quantity of potatoes being utilised (or its capacity) is often regarded as being particularly sensitive information. In addition, seasonal variation in the quantity of potatoes utilised can be substantial and therefore the throughput in any year can be misleading. In the light of these major difficulties it was recognised that any map could only provide a very rough indication of the size of plant. Consequently three very broad size groups were established and as a result of general discussions with members and independent observers of the industry each plant was allocated to one of these broad categories for the 1978/79 processing campaign. Given the problems of carrying out such an exercise it is inevitable that there may be some organisations which have been allocated to the wrong category, although this is perhaps not serious given the very limited aim of the exercise. It should also be noted that the map may not be complete as some organisations utilising only very small quantities of potatoes are not documented by the trade associations of some countries.

Only plants using fresh potatoes as raw material for the manufacture of potato products for human consumption are included.

KEY

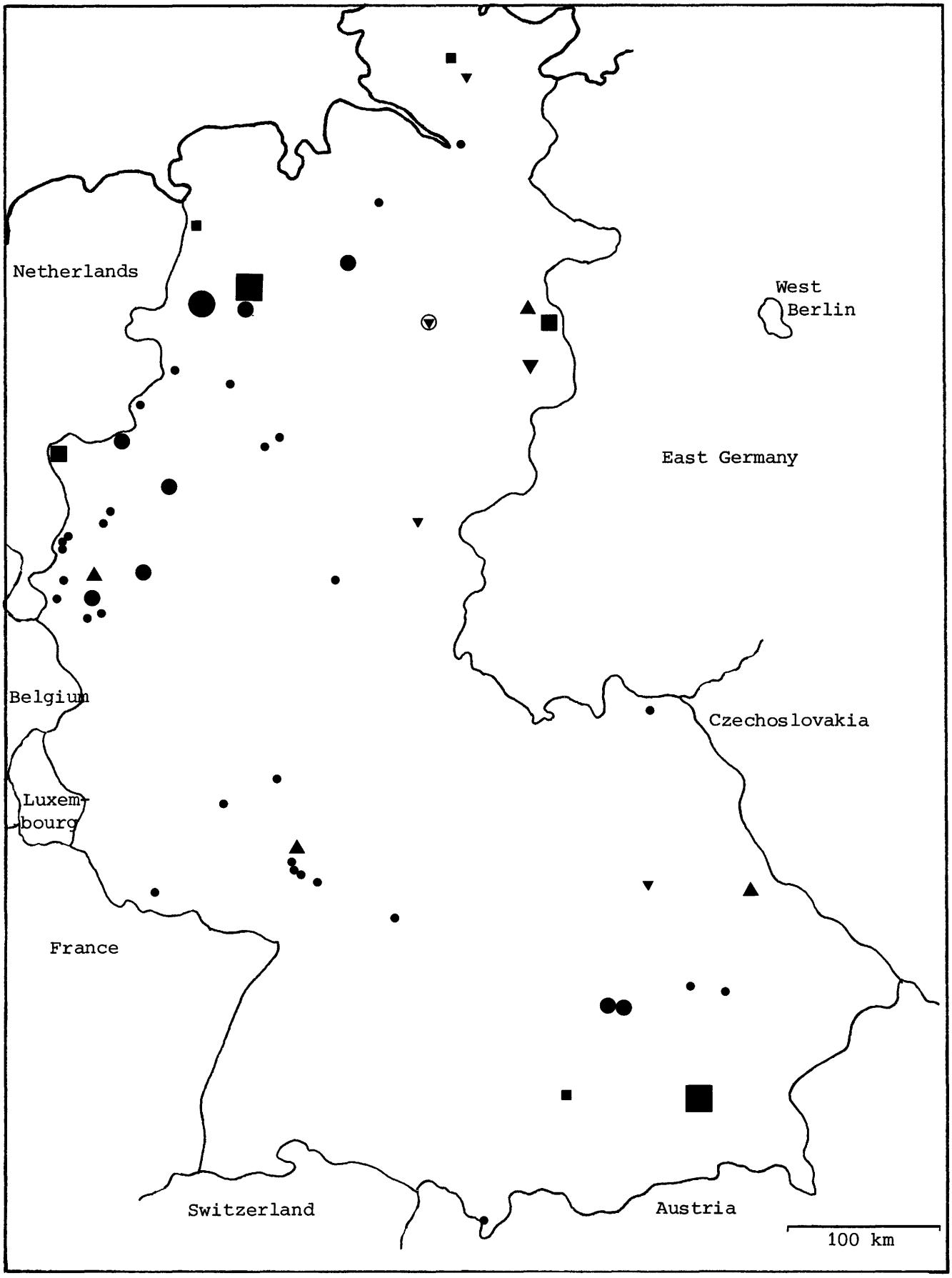
potatoes utilised annually	type of product	
• less than 10,000 tonnes)	french fries and other	Combined symbols represent multi-product plants. The outer symbol indicates the principal activity and quantity of potatoes utilised e.g. ◬ multi-product plant; main activity dehydrated products; utilising more than 50,000 tonnes.
● 10,000 - 50,000 tonnes)	fried non-snack	
⬤ more than 50,000 tonnes)	products	
■ less than 10,000 tonnes)		
■ 10,000 - 50,000 tonnes)	dehydrated products	
■ more than 50,000 tonnes)		
▲ less than 10,000 tonnes)		
▲ 10,000 - 50,000 tonnes)	crisps	
▲ more than 50,000 tonnes)		
▼ less than 10,000 tonnes)	miscellaneous products	
▼ 10,000 - 50,000 tonnes)	e.g. canned	

Map 1: The location of potato processing plants in the Netherlands and Belgium, 1979



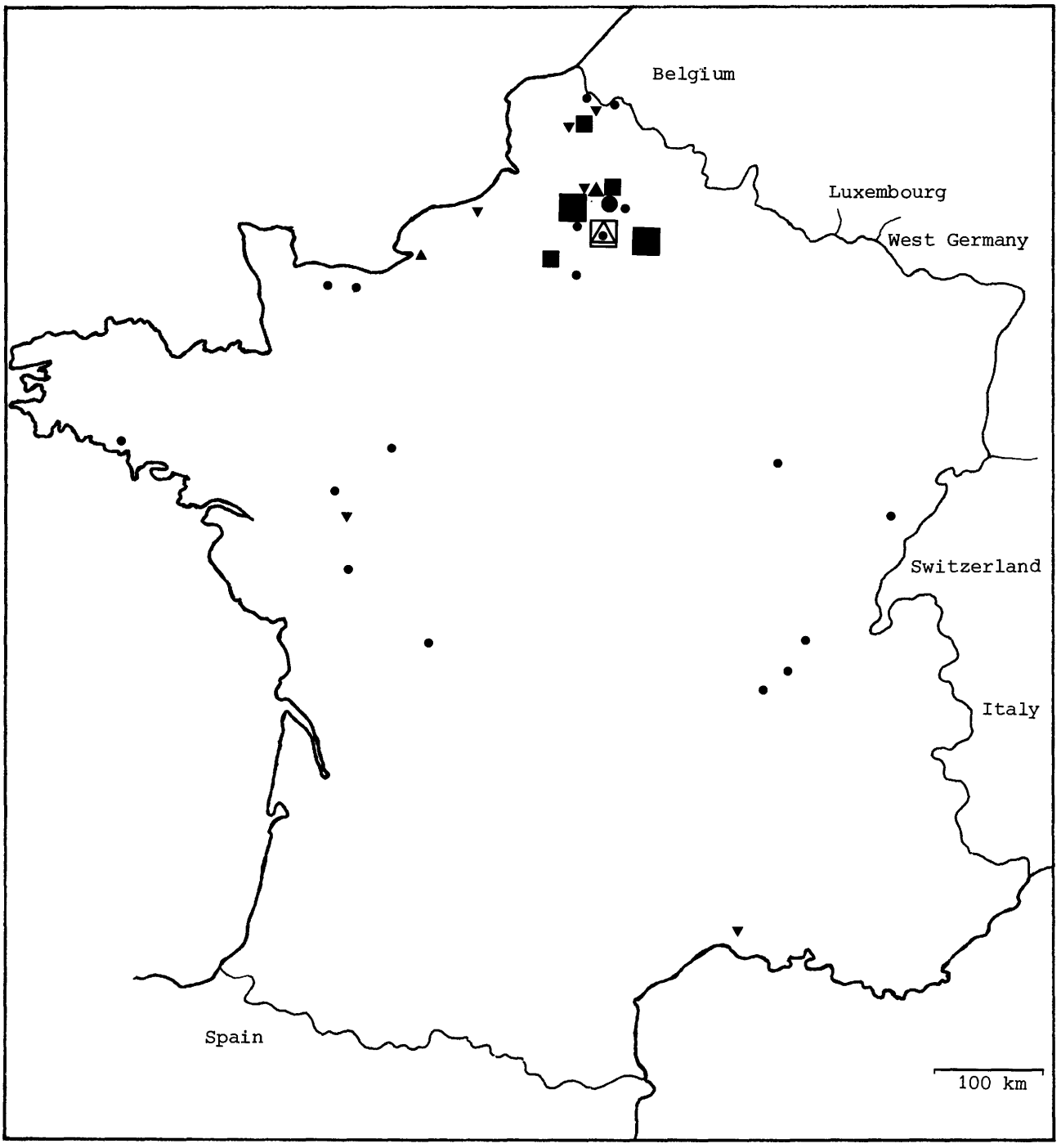
See notes to the maps and key on p. 202.

Map 2: The location of potato processing plants in West Germany, 1979



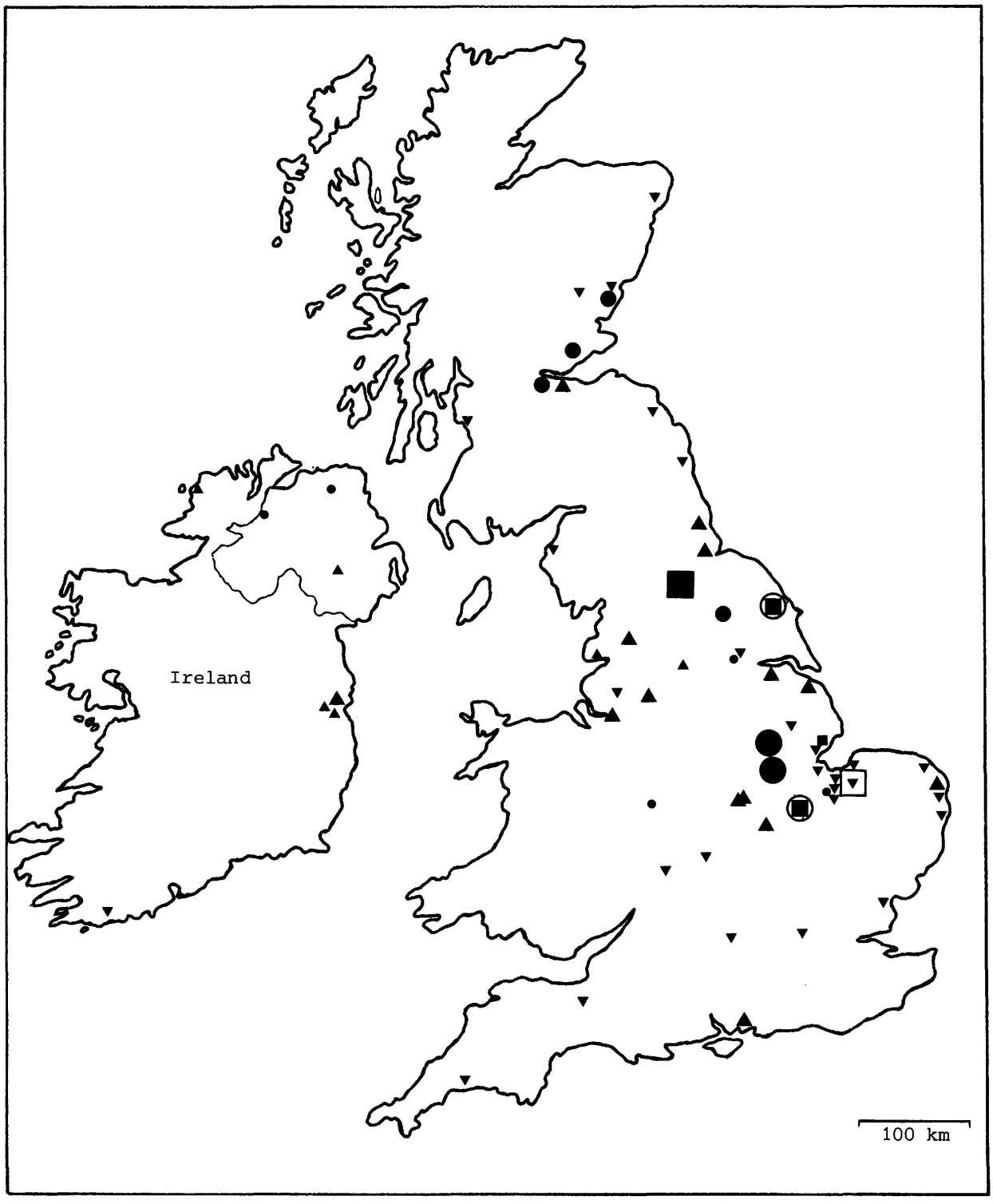
See notes to the maps and key on p. 202.

Map 3: The location of potato processing plants in France, 1979



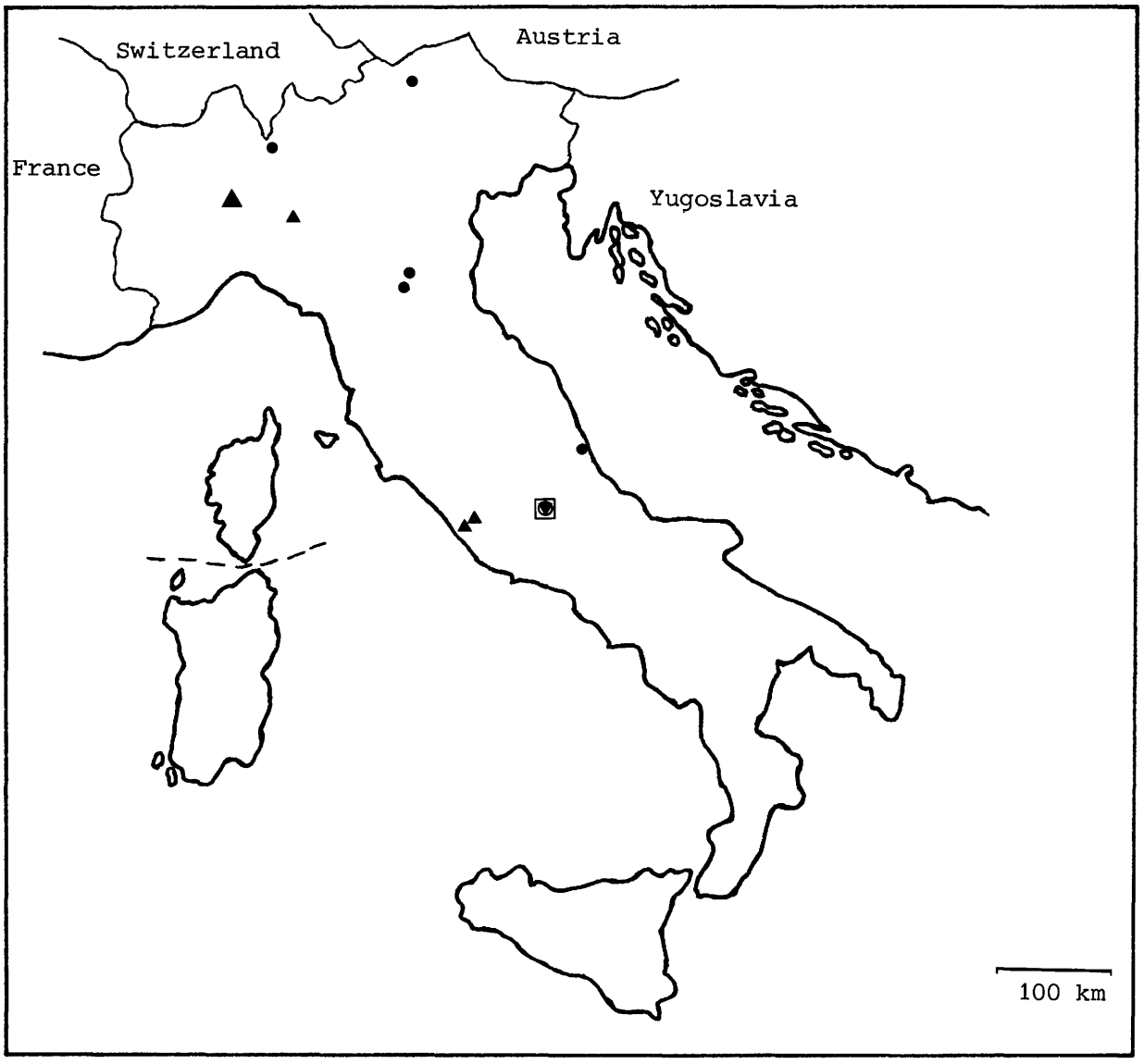
See notes to the maps and key on p. 202.

Map 4: The location of potato processing plants in the United Kingdom and Ireland, 1979



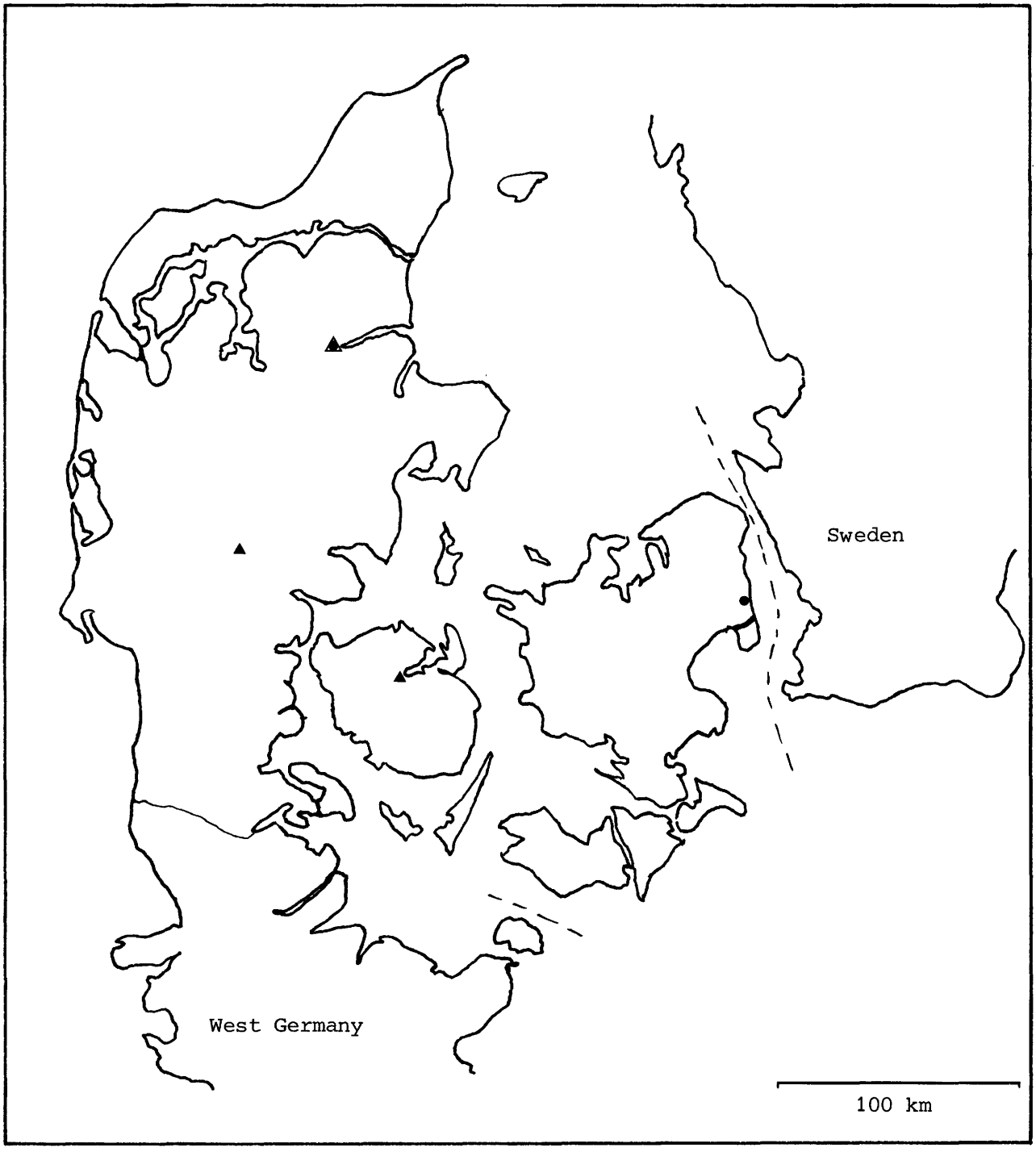
See notes to the maps and key on p. 202.

Map 5: The location of potato processing plants in Italy, 1979



See notes to the maps and key on p. 202.

Map 6: The location of potato processing plants in Denmark, 1979



See notes to the maps and key on p. 202.

APPENDIX II

A GLOSSARY OF THE PRINCIPAL POTATO PRODUCT GROUPS

English

French

German

Danish

Dutch

Italian

ENGLISH	FRENCH
Fried non-snack products	Produits précuits
french fries (or par-fried chips), frozen	(précuites or pre frites) pommes frites, surgélees
par-fried chips fresh (or par-fried)	(précuites or pre frites) pommes frites, réfrigérées
Fried snack products	Les chips et assimilés
potato crisps	pommes chips
potato sticks	pommes pailles
Dehydrated products	Produits déshydratés
instant mashed potato	purée instantanée
flakes	flocons
granules	poudre
dehydrated potato	pommes de terre déshydratés
dice	dés ou cubes
strips	bâtons
slices	rondelles
Other products	Divers produits
canned whole potatoes	conserves de pommes de terre (en boîtes)

GERMAN	DANISH
Vorgebratene Kartoffelerzeugnisse	Forstegte-Produkter
(vorgebratene) pommes frites, tiefgefroren	(forstegte) pommes frites, dybfrozen
(vorgebratene) pommes frites, frisch	(forstegte) pommes frites
Snackprodukte	Snack produkter
Kartoffel-chips	Kartofler chips
Kartoffel-sticks	
Trockenprodukte	Udtørret produkter
Kartoffel-püree	Kartoffelmos
Püreeflockon	Kartoffelmosflager
Püreepulver	Kartoffelmospulver
Trockenspeisekartoffeln	
Würfel	
Streifen	
Scheiben	
Kartoffelklossmehl	
Sonstige Kartoffelerzeugnisse	Forskelligt produkter
Dosenkartoffeln	Konserveskartofler

DUTCH	ITALIAN
Voorgebakken produkten	Pre-fritte prodotti
(voorgebakken) pommes (or patates) frites, diepgevroren	(semifritte (or pre-fritte)) patate, surgelate
(voorgebakken) pommes (or patates) frites, vers	(semifritte (or pre-fritte)) patate
Snack produkten	Prodotti snacks
aardappel chips	patatina
aardappel sticks	
Gedroogde produkten	Prodotti disidratati
aardappelpureepoeder	purè
pureevlokken	fiocchi di patate
pureepoeder	farina di patate
gedroogde aardoppelen	
blokjes	
strookjes	
schijfjes	
Andere produkten	Altri prodotti
Conserven aardappelen	patate in scatola

OTHER PRODUCTS[1]

Description	Names (in English/French/German)[2]
Thinly-cut fried potato strips	Shoestring/pommes frites allumettes/ Pommes Juliennes or Pommes allumettes or Strohkartoffeln
Grated potatoes mixed with egg, seasoning (and occasionally flour) shaped into flat pancakes and fried[3]	Kartoffelpuffer or Reibekuchen (West Germany)
Small fried whole potatoes or scooped potato balls	Baby roast potatoes/pommes parisiennes/Pariserkartoffeln
Small cubes of fried potato	Diced potatoes (UK)/Pommes Carrée (West Germany)
Sliced fried potato	Sauté potatoes/pommes sautées/ Bratkartoffeln in Scheiben
Mashed potato mixed with egg, cereal rusk and seasoning, cylindrically shaped and coated in breadcrumbs[3]	Croquette potatoes/croquettes de pomme de terre/Kartoffelkroketten (or, if shaped in balls, Pommes croquettes or Kartoffelbällchen)
Mashed potato (and often other ingredients) piped into pyramids[3]	Duchesse potatoes/pommes duchesse / Duchesse Kartoffeln or Pommes Duchesse
Mashed potato (and often other ingredients) shaped into flat pancakes[3]	Pommes galettes (France)/Pommes Omelettes (Macaire Kartoffeln) (West Germany)
Waffle-shaped crisps	Pommes gaufrettes (France)
A deep fried dish made from mashed potatoes, seasoning, eggs and pastry[4]	Pommes dauphines or pommes soufflé (France)

1 Terminology can vary from firm to firm (especially for some par-fried dishes). French names are commonly used for many potato dishes in the European Community.

2 Regional or national potato dishes are only named in the relevant language.

3 Either sold as par-fried product or as a preparation (usually dehydrated) requiring the addition of other ingredients.

4 Usually sold as a preparation requiring frying.

Grated potatoes mixed with other ingredients such as onion and bacon, shaped and fried[1]	Rösti (West Germany)
Whole cooked potatoes packed under vacuum	Stérilisée sous vide (France)
A potato based soup[2]	Kartoffelsuppe (West Germany)
Cooked potatoes (often mixed with other vegetables) in mayonnaise or salad cream	Potato salad (UK)/Kartoffelsalat (West Germany)
A meat dish with a mashed potato topping	Shepherds or cottage pie (UK)/ hachis parmentier (France)
Potatoes, other vegetables and meat in a pastry crust	Cornish pasties (UK)
Dumplings made from dehydrated potato, starch, seasoning and often other ingredients; made from raw potatoes, half raw/half cooked potatoes or from cooked potatoes	Knödel or Klösse; rohe; halb und halb; gekochte (West Germany)

1 Either sold as par-fried product or as a preparation (usually dehydrated) requiring the addition of other ingredients.

2 Usually sold in dehydrated form.

European Communities — Commission

Potato products: Production and Markets in the European Communities

Luxembourg: Office for Official Publications of the European Communities

1981 — 224 p. — 21 x 29,7 cm

Series Information on Agriculture — 75

EN

ISBN 92-825-2230-X

Catalogue number: CB-NA-80-075-EN-C

BFR 175	DKR 33,50	DM 11	DRA 258	FF 25,30
IRL 3	LIT 5100	HFL 11,80	UKL 2.40	USD 5,60

The study requested by the relevant division of the Directorate General for Agriculture, represents a thorough and detailed examination of the sector of potato processing.

In a rational succession the author examines the most important products: dried potatoes, pre-cooked and frozen products, potato crisps, croquettes and similar products, tinned potatoes etc. For each of these products the principal problems are exposed; acquisition of the raw material, the industrial processing, the marketing aspects.

Finally, the evolution of the processing industry in each Member State is examined.

The European industry, with three million tonnes of potatoes processed, represents a very dynamic sector in continuous evolution, notably for certain products (precooked and frozen). The contracts between the grower and the processing industry represent a stabilising element in the market which is very useful for the general equilibrium of the sector. The use of certain varieties gives an important orientation to the seed potato branch.

Certain problems exist and it is necessary to study and resolve them at the Community level; the competition of dried products from North America and certain Eastern countries; national measures which are the elements of distortion of competition among the EC countries; the use of chemical additives, etc.

The European processing industry is able to react to all negative situations, on condition that it may operate, as the author would wish it in his conclusions, in conditions of complete freedom. However, actions at Community level can be undertaken in certain areas for an improved development of this sector.

This study is only published in English

Information on Agriculture

		Year	Languages
No. 1	Credit to agriculture I. France, Belgium, GD Luxembourg	1976	F
No. 2	Credit to agriculture II. Federal Republic of Germany	1976	D
No. 3	Credit to agriculture III. Italy	1976	F I
No. 4	Credit to agriculture IV. The Netherlands	1976	E N
No. 5	Map of the duration of the vegetationperiod in the Member States of the Community	1976	F D
No. 6	Models for analysis mixed crop and cattle farms Basic techno-economic data: Schwäbisch-bayerisches Hüggel-and (Federal Republic of Germany)	1976	D
No. 7	Models for analysis mixed crop and cattle farms Basic techno-economic data: South-East Leinster (Ireland), West Cambridgeshire (United Kingdom), Fünen (Denmark)	1976	E
No. 8	Provisions on bovine husbandry	1976	F
No. 9	Forms of cooperation in the fishing industry — Denmark, Ireland, United Kingdom	1976	E
No. 10	The milk and beef markets in the Community — A regional approach for the achievement of equilibrium	1976	D E
No. 11	The contribution of the "mountain communities" in Italy to the development of hill farming	1976	I
No. 12	The Italian "enti di sviluppo agricolo" (agricultural development bodies) in the structural reform — Adjustment problems and prospects	1976	I
No. 13	Markets for fresh lemons and lemon juice in the European Community	1976	E F
No. 14	Pesticide residues in tobacco and tobacco products I. General report	1976	F E
No. 15	Water content of frozen or deep-frozen poultry. — Examination of methods of determination	1976	F E
No. 16	Methods for the detection of the viruses of certain diseases in animals and animal products	1976	E
No. 17	Veterinary Vaccines — A comparative analysis of regulations in the Member States for three major diseases	1976	E
No. 18	The foreseeable trend in world availabilities of agricultural products and the consequences for the Community I. Wheat, feed grain, sugar — Summary	1976	D F
No. 19	The foreseeable trend in world availabilities of agricultural products and the consequences for the Community II. Beef, sheepmeat, milk products	1976	D F
No. 20	Forms of cooperation between farms for production and marketing in the new Member States	1976	E
No. 21	Objectivation of the bacteriological and organoleptic quality of milk for consumption	1976	E
No. 22	Evaluation of the hygienic problems related to the chilling of poultry carcasses	1976	E

		Year	Languages
No. 23	Pesticide residues in tobacco products II. Plant protection products used — Legislation — Methods of analysis	1976	F E
No. 24	Practical means for the application of methods of integrated pest control	1976	F
No. 25	Forestry problems and their implications for the environment in the member States of the EC I. Results and recommendations	1976	D F E
No. 26	Pesticide residues in tobacco and tobacco products III. Pesticide residues found in tobacco — Toxicological aspects of residues in tobacco	1976	F E
No. 27	The marketing of imported fruit and vegetables in the EC	1977	F
No. 28	Credit to agriculture in the EC Member States — A comparative analysis	1977	E F
No. 29	The cost of first processing and packing of unworked tobacco produced in the Community	1977	I F
No. 30	Review of pre-slaughter Stunning in the EC	1977	E D
No. 31	Forestry problems and their implications for the environment in the Member States of the EC II. Access of the public to forests and their use for recreational purposes	1977	D
No. 32	Forestry problems and their implications for the environment in the Member States of the EC III. Position, development and problems of mechanization of stand establishment and timber harvesting	1977	D
No. 33	Forestry problems and their implications for the environment in the Member States of the EC IV. State aid for the financing of forestry measures in forests not owned by the State	1977	D
No. 34	Forestry problems and their implications for the environment in the Member States of the EC V. Systems of forest taxation and the tax liability of private forest holdings	1977	D
No. 35	Projections for the agricultural sector — Forecasts of the trends in farm structures and factor input in agriculture in the EC I. Theoretical basis and analysis of existing studies	1977	D
No. 36	The foreseeable trend in world availabilities of agricultural products and the consequences for the Community III. Oils and fats, protein products	1977	D
No. 37	Models for analysis mixed crop and cattle farms — Basic techno-economic data: Bassin de Rennes (France)	1977	F
No. 38	Determination of the proportion of lean meat on pig carcasses using the Danish KSA-equipment	1977	D E
No. 39	Models for analysis mixed crop and cattle farms — Basic techno-economic data: Volvestre (France)	1977	F
No. 40	Influence on health of different fats in food	1977	E F
No. 41	Models for analysis mixed crop and cattle farms — Basic techno-economic data East-Aberdeenshire (Scotland)	1977	E

		Year	Languages
No. 42	Water content of frozen or deep-frozen poultry — Examination of methods of determination: turkeys	1977	F E
No. 43	A prognosis and simulation model for the EC cereals market *Part I:* Bases, conception of the model and quantification of factors determining supply and price formation *Section I:* Theoretical bases and conception	1978	D
No. 44	A prognosis and simulation model for the EC cereals market *Part I:* Bases, conception of the model and quantification of factors determining supply and price formation *Section II:* Development and factors determining supply and cereal producer prices	1978	D E
No. 45	Cereals and meat in Eastern Europe *Section I:* Text	1978	D E
No. 46	Cereals and meat in Eastern Europe *Section II:* Tables	1978	D E
No. 47	The spreading of animal excrement on utilized agricultural areas of the Community I. Scientific bases for the limitation of quantities and criteria for rules thereon	1978	F N E
No. 48	The spreading of animal excrement on utilized agricultural areas of the Community II. Characterization of the region with intensive animal farming A. Report	1978	D
No. 49	The spreading of animal excrement on utilized agricultural areas of the Community II. Characterization of the region with intensive animal farming B. Statistical data: Basic regional data and coefficients	1978	D
No. 50	The spreading of animal excrement on utilized agricultural areas of the Community II. Characterization of the region with intensive animal farming C. Statistical data: Regional concentration of animal farming	1978	D
No. 51	The spreading of animal excrement on utilized agricultural areas of the Community III. Summary and conclusions	1978	N F E D
No. 52	The structural and socio-economic situation and development in the agricultural regions of the Community I. Report	1978	F
No. 53	The structural and socio-economic situation and development in the agricultural regions of the Community II. Explanatory annexes and statistical data by major regions	1978	F
No. 54	The structural and socio-economic situation and development in the agricultural regions of the Community III. The statistical data for the 376 districts on which the report is based	1978	F
No. 55	Possibilities for and constraints on the marketing of fruits and vegetables meeting defined quality standards	1978	F
No. 56	System of codification for forest reproductive material A. Text	1978	D F(1)
No. 57	System of codification for forest reproductive material B. Main Commodity Catalogue	1978	D

(1) In preparation

		Year	Languages
No. 58	System of codification for forest reproductive material C. Catalogue of Poplars of commercial value, Index of Provenances, Catalogue of Qualities, Index of Tree Species	1978	D
No. 59	Gross margins for agricultural products in the Italian regions	1978	I
No. 60	Additional Quality standards for chicken and eggs	1978	F
No. 61	Microbiology and shelf-life of chilled poultry carcasses	1978	E
No. 62	Effects on the environment of the abandonment of agricultural land	1979	D F(1) E
No. 63	Agricultural situation and food supply in certain Arab and Mediterranean countries and their foreseeable development I. Trends and prospects by area and by product	1979	F
No. 64	Agricultural situation and food supply in certain Arab and Mediterranean countries and their foreseeable development II. Methodological and statistical annexes	1979	F
No. 65	Projections for the agricultural sector — Forecasts of the trends in farm structures and factor input in agriculture in the EC II. Analysis and forecasts, empirical results — General part	1979	D E
No. 66	Projections for the agricultural sector — Forecasts of the trends in farm structures and factor input in agriculture in the EC III. Analysis and forecasts, empirical results — Report by country	1979	D E
No. 67	Water content of frozen or deep-frozen poultry Examination of methods of determination: Guinea-fowls and ducks	1979	F E
No. 68	Possibilities of reduction of the quantities of phyto-sanitary products employed in agriculture	1979	F
No. 69	Dehydratation of green fodder in the EC — Technical and economic study	1979	F
No. 70	Development of uniform methods for pig carcass classification in the EC	1979	E
No. 71	Water content of frozen or deep-frozen poultry — Comparison of methods of determination	1980	E F D(1)
No. 72	The problems of oriental tobacco production in the EC	1980	I F E(1)
No. 72	Maps		
No. 73	Factors influencing ownership, tenancy, mobility and use of farmland in Denmark	1980	E
No. 74	Factors influencing ownership, tenancy, mobility and use of farmland in the United Kingdom	1980	E
No. 75	Potato products: Production and markets in the EC	1980	E

(1) In preparation.

Salgs- og abonnementskontorer · Vertriebsbüros · Sales Offices
Bureaux de vente · Uffici di vendita · Verkoopkantoren

Belgique - België

Moniteur belge – Belgisch Staatsblad
Rue de Louvain 40-42 –
Leuvensestraat 40-42
1000 Bruxelles – 1000 Brussel
Tél. 512 00 26
CCP 000-2005502-27
Postrekening 000-2005502-27

Sous-dépôts – Agentschappen:
Librairie européenne – Europese Boekhandel
Rue de la Loi 244 – Wetstraat 244
1040 Bruxelles – 1040 Brussel

CREDOC
Rue de la Montagne 34 - Bte 11 –
Bergstraat 34 - Bus 11
1000 Bruxelles – 1000 Brussel

Danmark

J.H. Schultz – Boghandel
Møntergade 19
1116 København K
Tlf. (01) 14 11 95
Girokonto 200 1195

Underagentur:
Europa Bøger
Gammel Torv 6
Postbox 137
1004 København K
Tlf. (01) 15 62 73
Telex: 19280 euroin dk

BR Deutschland

Verlag Bundesanzeiger
Breite Straße – Postfach 10 80 06
5000 Köln 1
Tel. (0221) 21 03 48
(Fernschreiber: Anzeiger Bonn 8 882 595)
Postscheckkonto 834 00 Köln

France

Service de vente en France des publications des Communautés européennes
Journal officiel
26, rue Desaix
75732 Paris Cedex 15
Tél. (1) 578 61 39 – CCP Paris 23-96

« Service de documentation »
D.E.P.P.
Maison de l'Europe
37, rue des Francs-Bourgeois
75004 Paris
Tél. 887 96 50

Ireland

Government Publications
Sales Office
G.P.O. Arcade
Dublin 1

or by post from

Stationery Office
Dublin 4
Tel. 78 96 44

Italia

Libreria dello Stato
Piazza G. Verdi 10
00198 Roma – Tel. (6) 8508
Telex 62008
CCP 387001

Grand-Duché de Luxembourg

Office des publications officielles des Communautés européennes
5, rue du Commerce
Boîte postale 1003 – Luxembourg
Tél. 49 00 81 – CCP 19190-81
Compte courant bancaire:
BIL 8-109/6003/300

Nederland

Staatsdrukkerij- en uitgeverijbedrijf
Christoffel Plantijnstraat, 's-Gravenhage
Postbus 20014
2500EA s'-Gravenhage
Tel. (070) 78 99 11
Postgiro 42 53 00

United Kingdom

H.M. Stationery Office
P.O. Box 569
London SE1 9NH
Tel. (01) 928 69 77, ext. 365
National Giro Account 582-1002

United States of America

European Community Information Service
2100 M Street, N.W.
Suite 707
Washington, D.C. 20 037
Tel. (202) 862 95 00

Schweiz - Suisse - Svizzera

Librairie Payot
6, rue Grenus
1211 Genève
Tél. 31 89 50
CCP 12-236 Genève

Sverige

Librairie C.E. Fritze
2, Fredsgatan
Stockholm 16
Postgiro 193, Bankgiro 73/4015

España

Libreria Mundi-Prensa
Castelló 37
Madrid 1
Tel. 275 46 55

Andre lande · Andere Länder · Other countries · Autres pays · Altri paesi · Andere landen

Kontoret for De europæiske Fællesskabers officielle Publikationer · Amt für amtliche Veröffentlichungen der Europäischen Gemeinschaften · Office for Official Publications of the European Communities · Office des publications officielles des Communautés européennes · Ufficio delle pubblicazioni ufficiali delle Comunità europee · Bureau voor officiële publikaties der Europese Gemeenschappen

Luxembourg 5, rue du Commerce Boîte postale 1003 Tél. 49 00 81 · CCP 19 190-81 Compte courant bancaire BIL 8-109/6003/300

BFR 175 DKR 33,50 DM 11 DRA 258 FF 25,30 IRL 3 LIT 5100 HFL 11,80 UKL 2.40 USD 5.60

OFFICE FOR OFFICIAL PUBLICATIONS
OF THE EUROPEAN COMMUNITIES

ISBN 92-825-2230-X

Boîte postale 1003 — Luxembourg

Catalogue number: CB-NA-80-075-EN-C